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ABSTRACT

Emphasis in this manual is on translating an institutional plan into the activities required for the capital expansion of an institution of higher education. The total institutional planning function is described and analyzed in detail in order to implement facility construction plans in an orderly and cost-effective manner. Four major categories are identified: management planning, physical plant planning, financial planning, and project management planning. Separate sections of this guide deal with: the building system; institutional long-range planning; researching for building; sources of federal funds; the college-architect relationship; innovation in design; project management; and bidding and completing the building. A bibliography is included. (LBH)

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A CONSTRUCTION MANUAL FOR INSTITUTIONS OF HIGHER LEARNING

FROM THE GROUND UP...

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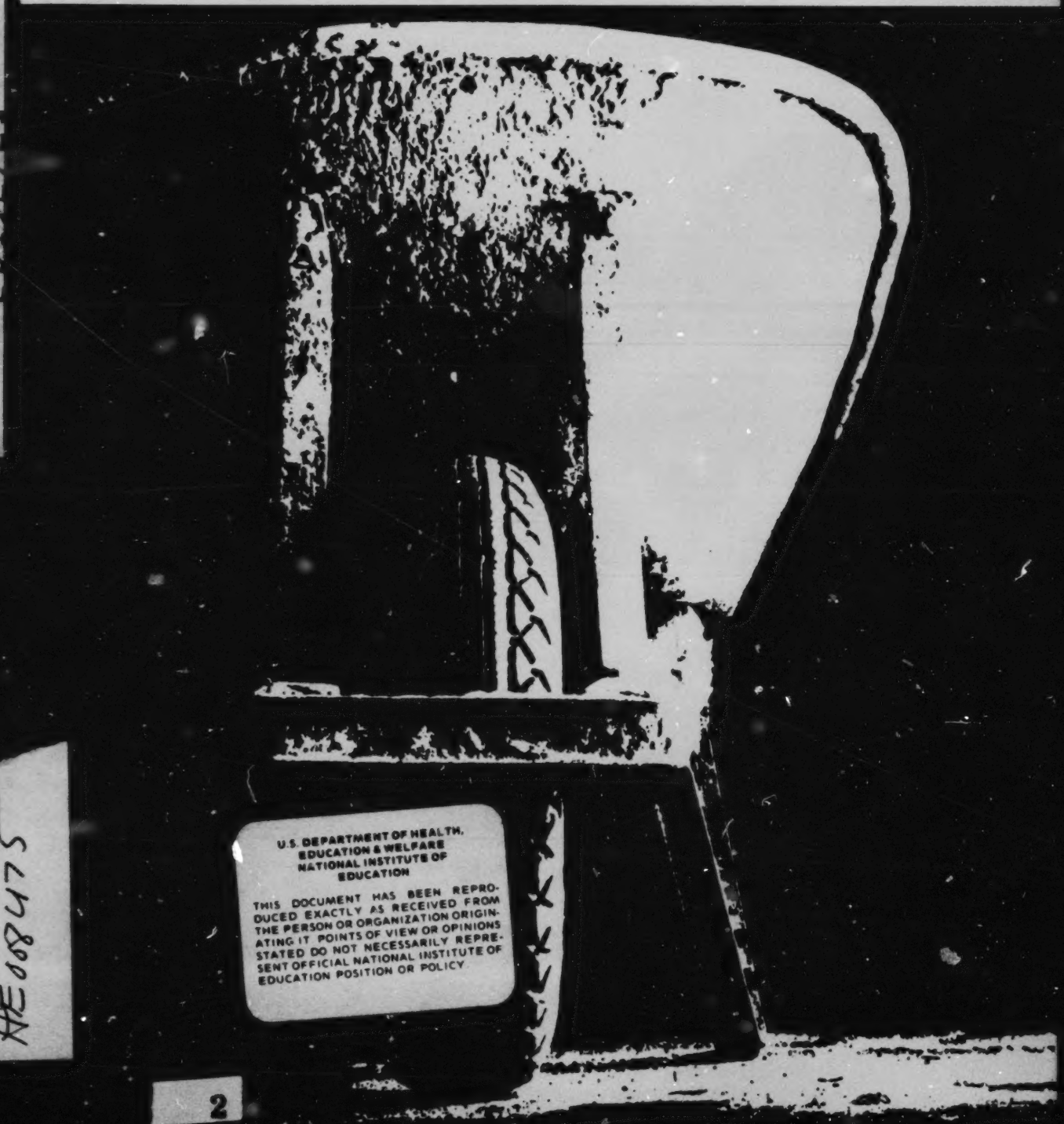

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FROM THE GROUND UP . . . .

A Construction Manual for Institutions of Higher Learning Prepared for the New Hampshire Higher Education Facilities Commission

December, 1971

Benjamin Donatelli and Dennis Binning

Decision Research, Incorporated
967 Elm Street
Manchester, New Hampshire 03101

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The foresight of Atty. Edward Wynot, Chairman of the New Hampshire Higher Education Facilities Commission, and the Commission's Executive Secretary, Mr. Albert Hall, made this manual possible under a planning grant from the Division of Academic Facilities via the State Commission. We wish to thank Dr. Everett Sackett, former Executive Secretary of the New Hampshire Coordinating Board of Advanced Education and Accreditation, for his support throughout the project.

Throughout the manual we have cited directly and indirectly guides and procedures that we felt would be most helpful to those individuals involved in capital expansion projects. We are most indebted to the authors of the following documents (listed below alphabetically) and we encourage our readers to consult these documents for further reading:

Bricks and Mortarboards, A Report on College Planning and Building; published by The Educational Facilities Laboratories, Inc., 477 Madison Avenue, New York, New York 10022.

Creative Approaches to Facilities Development; a series of circulas published by the Department of Health, Education and Welfare, Office of the Secretary, Facilities Engineering and Construction Agency, Washington, D.C. 20201.

Guidelines for Planning in Colleges and Universities; a Report Developed for: The Coordinating Board. Texas College and University System, July 1968.

Higher Education Facilities Planning and Management Manuals; Planning and Management Systems Division, Western Interstate Commission for Higher Education, in cooperation with The American Association of Collegiate Registrars and Admissions Officers.

And special acknowledgements are due to College Management and College and University Business magazines whose back issues were frequently consulted.

A special note of thanks to A. Anthony Tappe' of Huygins and Tappe', Inc., Architects and Planners, Boston, Mass., for his analysis and suggestions relating to the architect's many roles and responsibilities, reflected in the chapter "The College and the Architect."

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INTRODUCTION

This volume is intended to provide the basic materials with which to translate an institutional plan into the activities required for the capital expansion of an institution of higher education.

Decision Research began this project with the charge to develop an easy-to-use referential document to be used in the developmental planning of facilities for institutions of higher learning within the State of New Hampshire. Obviously, the purpose of this manual is not to judge the developing direction of our institutions of higher education, that is the topic for yet another comprehensive attempt at co-operative state-wide planning. Each institution has its own uniqueness and planning judgments must be made with reference to that uniqueness; yet, this manual is to be an institutional planning guide to assist them in avoiding many pitfalls in facility construction.

It is hoped that this reference manual will allow institutions to implement their facility plans in an orderly and cost-effective manner. In order to make this document more relevant to the problems that we found in a great number of the state's institutions, much more time and effort has gone into describing and analyzing the total institutional planning function than was originally budgeted.

This decision was made with some hesitancy for we realize that over the last three years, the New Hampshire Higher Education

Facilities Commission has made a concentrated effort to organize and develop the necessary materials to form a data base for a continuing system of facilities planning. After researching this material, however, we found that the planning process was not discussed, only the data necessary for planning decisions had been produced. This data base on higher education in New Hampshire does contain information on facilities, faculty, staff, students, graduates, land, buildings, finances, demography, migration, and projections, but does not begin to relate the isolated pieces of information into any workable format, especially for individual institutional use.

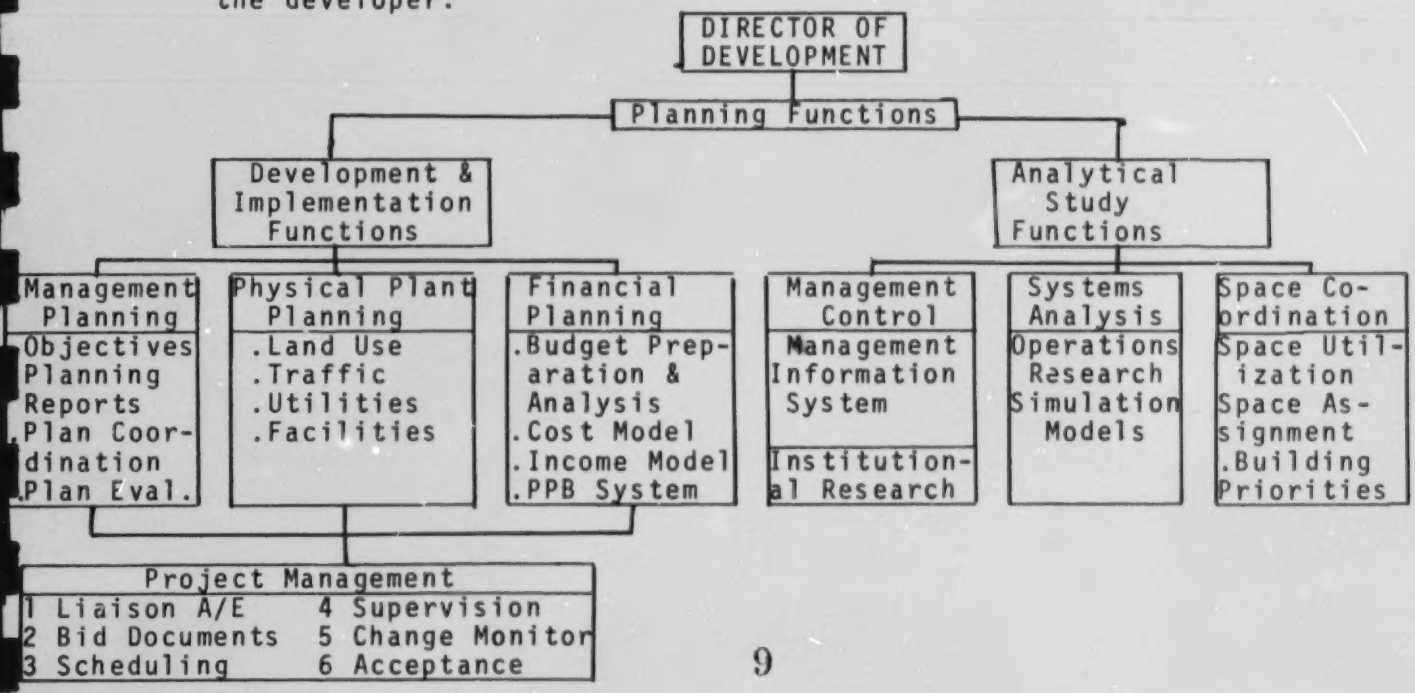
This decision to comprehensively investigate the planning process was reinforced by an article presented in the September 1970 issue of College and University Business on campus planning in which Robert Anderson is quoted as saying: "So often what passes for campus planning is about as meaningful an occupation as engraving the Lord's Prayer on the head of a pin." What Mr. Anderson is pointing out is that although college administrators have in the past arduously labored with campus planning, the yield of this process has not been consistent with the effort.

The emphasis that Decision Research placed as its examination of the institutional planning process rested soundly on the theory that the "wholeness" of institutions is paramount and pointed to the fact that the planning process which best benefits educational institutions is composed of an extensive system of interrelated and interdependent efforts of individuals

and units within the administrative and academic area of the institution. The actual planning process is essentially multi-lineal in character making it necessary to categorize planning activities through explicit and interrelated working units.

Decision Research approached the planning process from the viewpoint of the development officer. We distinguish him from his fellow administrators in that he is usually the central figure in the communications network of the institution. His office is generally responsible for the coordination of the functions necessary for the institutional planning process to be meaningful. We believe him to also be the person who is responsible for the implementation of the completed plans and, therefore, the person to whom this manual will be especially useful.

The following chart is our interpretation of the functions of the developer:



Based on this premise, we divided the multi-lineal planning process into the following four major categories:

1. Management Planning
2. Physical Plant Planning
3. Financial Planning
4. Project Management Planning

In brief but concise form, the following is a description of each of these areas.

Management Planning

The Management Planning process is initiated by the establishment of institutional objectives. In view of these objectives, the administrative hierarchy generates organizational units and programs to accomplish these objectives. The organizational units in turn generate a list of research requirements for the establishment of the institutional plan.

Physical Plant Planning

The Physical Plant Planning process involves data collection and data analysis both for operating systems and planning systems. Plant Planning is necessarily involved in four categories of activities: 1) land use planning, 2) facilities planning, 3) utilities planning, and 4) traffic planning. Each of these categories are critical to effective utilization of plant and to future effective utilization due to campus growth.

Financial Planning

Decision Research has viewed the financial process as having a multi-faceted objective. It is the Financial Planning process which most importantly gives the key to the plan's feasibility. Basically, the areas covered under Financial Planning are: (1) project cost estimation, (2) cash-flow analysis, (3) income models, (4) expense models, and (5) pro-forma statements incorporating all of the above. The actual Financial Planning function takes on the appearance of a Planning-Programming-Budgeting-System and is in effect a closed cycle budgeting system that is used to constantly monitor the existing financial position of the institution and project operating changes into financial forecasts. Using this type of Financial Planning cycle, an administrator can assess and project chance of success before committing substantial institutional resources into the actual preconstruction planning.

Project Management Planning

The Project Management Planning process is the deliberate phasing of other planning and information gathering/analysis processes at the point where a building project can be said to be "fully underway." In this sense, a building is fully underway long before a spade bites into the earth. Phasing of design and engineering phases, cash-flow monitoring, work supervision, change order supervision, etc. all are functions of this process.

It must be emphasized that Decision Research makes clear note that these four planning processes are not distinct entities but are interrelated. We point out such things as the fact that the physical plant planning stage converts the faculty requirements of the management planning process into specific facility requirements for which cost estimates can be developed and debt service support can be analyzed.

While an extensive amount of time has been spent in the examination of the institutional planning process, we have also begun to analyze the steps necessary for preconstruction planning in the actual project management. The concept of the school design is no longer an architecturally isolated topic. It is easily recognized that the system of higher education is a microcosm of the social structure of the United States and that there is now an increasing emphasis that school design is no longer limited to rigid design formats of the past where institutions were normally designed after a limited number of precast models.

Recent changes in our society have placed a great deal of pressure on our institutions to design and produce flexible and adaptable physical plants. For example, utilization of existing landscapes and regional materials can produce a more flexible and cost efficient facility than some of the more traditionally designed facilities.

Also, by surfacing the spaces between buildings and by sheltering them from the elements, areas for classes, seminars, and

and socializing can be produced from formerly non-assignable space. Such utilization is pointed out to be extremely advantageous to the college that is under pressure because of limited funds for expansion into new buildings.

These are only a few examples covered in the design portion of the manual.

Investigation of architectural literature has led us to point out that new techniques and materials can speed construction, lower initial and future maintenance costs, and produce some very exciting, aesthetically pleasing structures.

The continuous change in technology and materials, however, has produced a great deal of confusion in the minds of college administrators and planners and the manual is designed to encourage administrators to make full use of the services available to them from their architects.

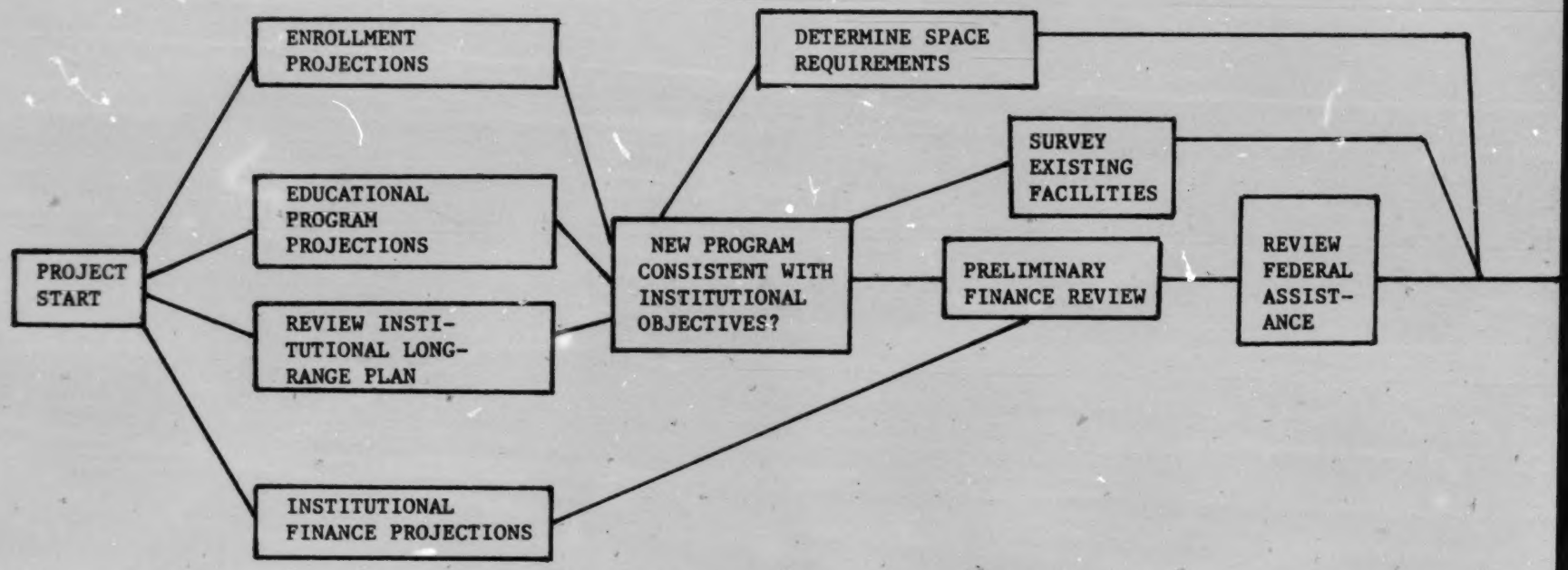
And use these services they will, for higher education in America is still the most explosive "growth" market in the nation. Conservative estimates state that facilities construction for higher education will reach some $7 billion annually by 1980, while the total operating budget will reach upwards of $40 billion a year -- some 4 per cent of the projected gross national product. While enrollment projections call for a leveling off in the late 70's, replacement of physical plant alone will reach unprecedented levels. We see in this era a new chance for institutions of higher learning, no matter how small or how

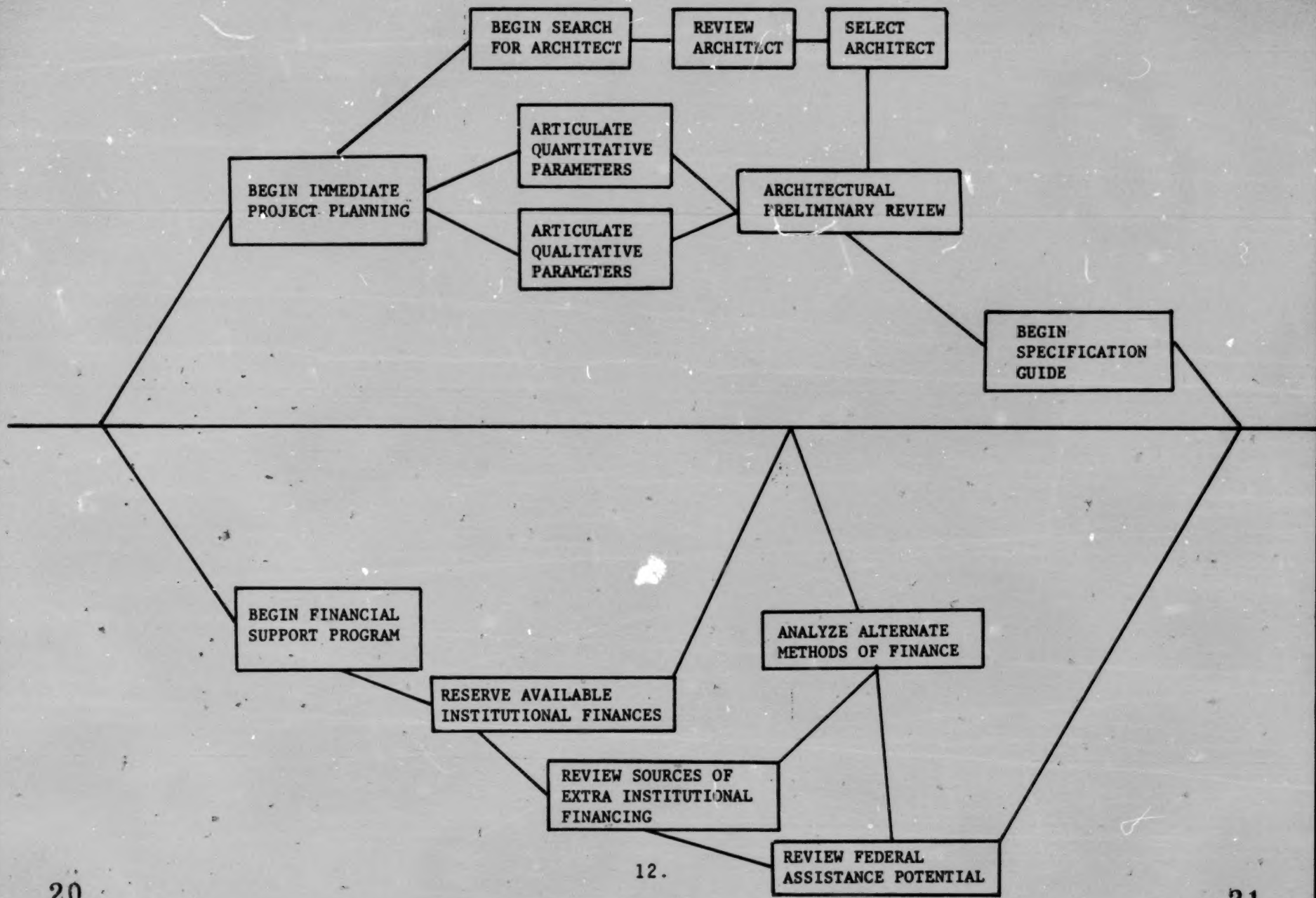
large, to design and build outstanding learning environments (facilities) with ease and certainty. This manual is dedicated to serving, in at least a small way, this end.

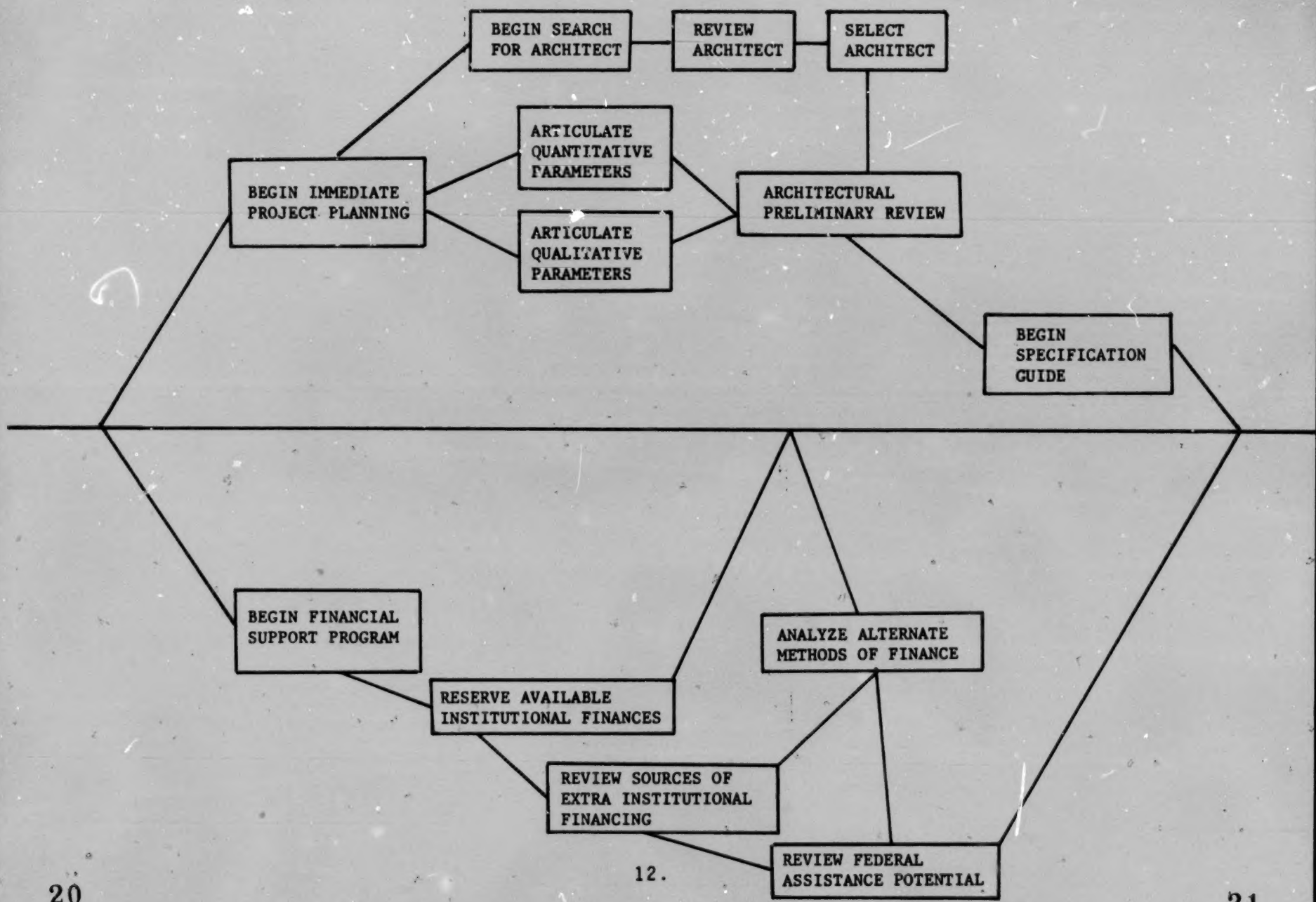
THE BUILDING SYSTEM

It would be helpful to have a kind of road map to guide us as we plan and build new facilities on campus. In fact, building a new building is much like taking an automobile trip of some distance: there must be a desire to travel; we must look at the various places to which it would be desirable to travel; we must finally decide where it is we are going; we must plan in advance to pay for the trip; we should establish some guideposts to tell us whether we are getting there as comfortably and as quickly as planned; and we, hopefully, will finally arrive at our destination.

This manual has been organized in its various chapters as a kind of road map to building, in narrative form. To complete the analogy, however, we felt it would be useful to actually have a map of the generalized system we are discussing available for all as a reference. On the following six pages will be found a conceptualization of the basic steps necessary to building a building. It may be a useful tool (as a checklist) to you later as you build and more immediately as a kind of graphic table of contents.


PROJECT START
ENROLLMENT PROJECTIONS
EDUCATIONAL PROGRAM PROJECTIONS
REVIEW INSTI-TUTIONAL LONG-RANGE PLAN
INSTITUTIONAL FINANCE PROJECTIONS
NEW PROGRAM CONSISTENT WITH INSTITUTIONAL OBJECTIVES?
DETERMINE SPACE REQUIREMENTS
SURVEY EXISTING FACILITIES
PRELIMINARY FINANCE REVIEW
REVIEW FEDERAL ASSIST-ANCE


BEGIN SEARCH FOR ARCHITECT
REVIEW ARCHITECT
SELECT ARCHITECT
ARTICULATE QUANTITATIVE PARAMETERS
BEGIN IMMEDIATE PROJECT PLANNING
ARCHITECTURAL PRELIMINARY REVIEW
ARTICULATE QUALITATIVE PARAMETERS
BEGIN SPECIFICATION GUIDE
BEGIN FINANCIAL SUPPORT PROGRAM
ANALYZE ALTERNATE METHODS OF FINANCE
RESERVE AVAILABLE INSTITUTIONAL FINANCES
REVIEW SOURCES OF EXTRA INSTITUTIONAL FINANCING
REVIEW FEDERAL ASSISTANCE POTENTIAL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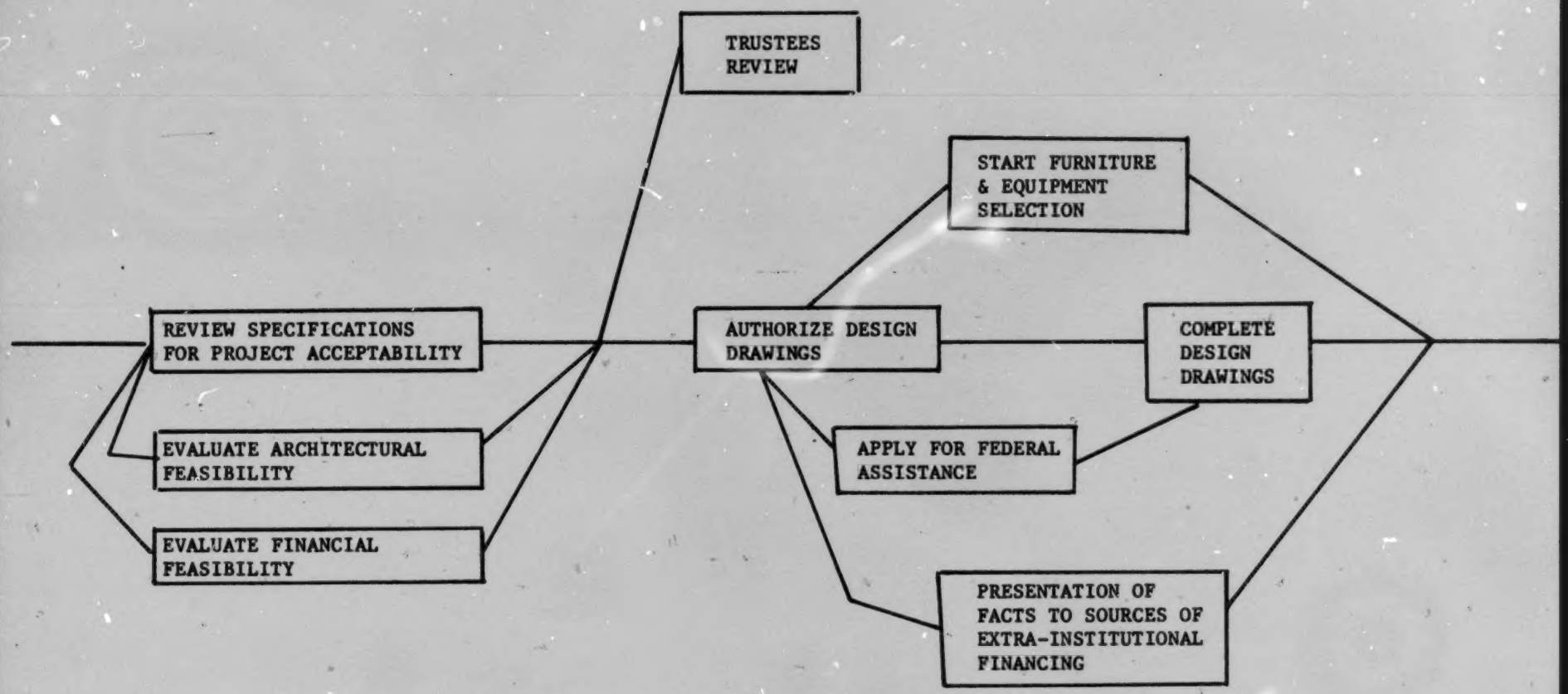
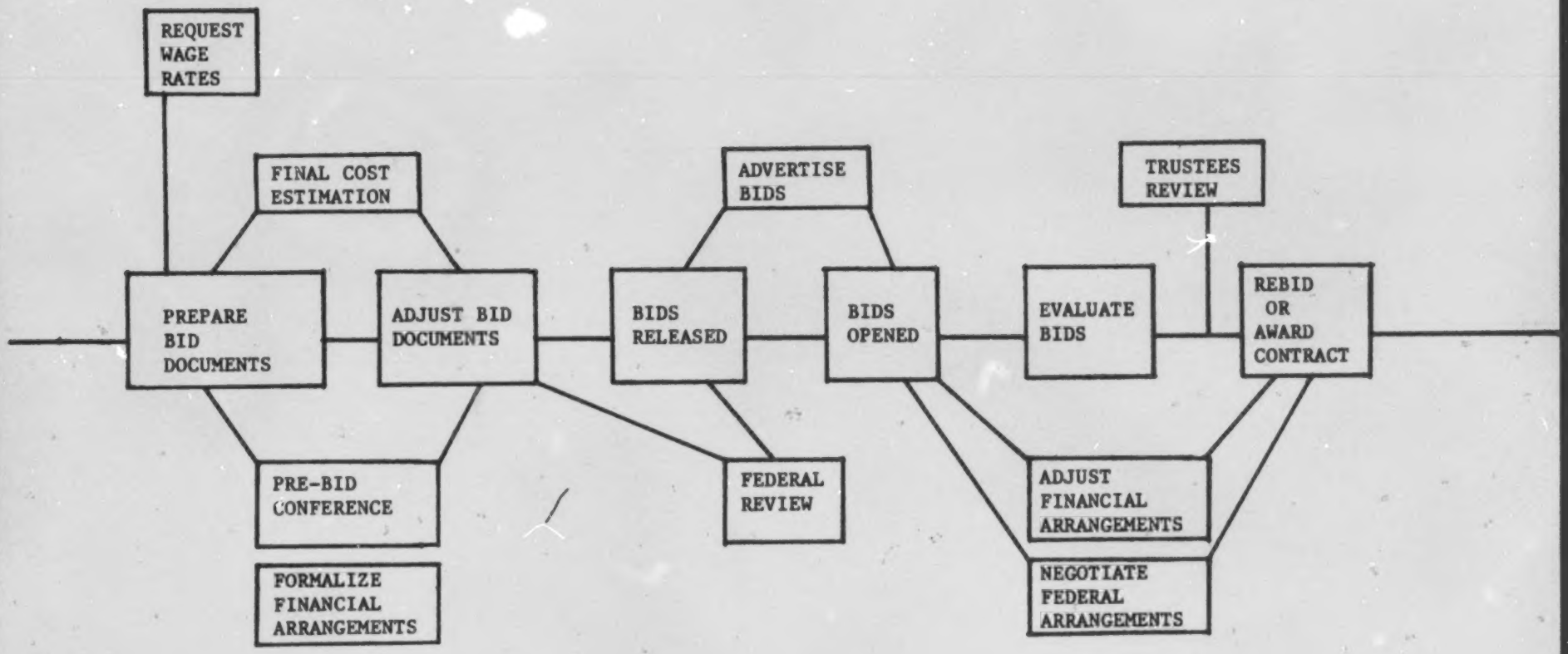
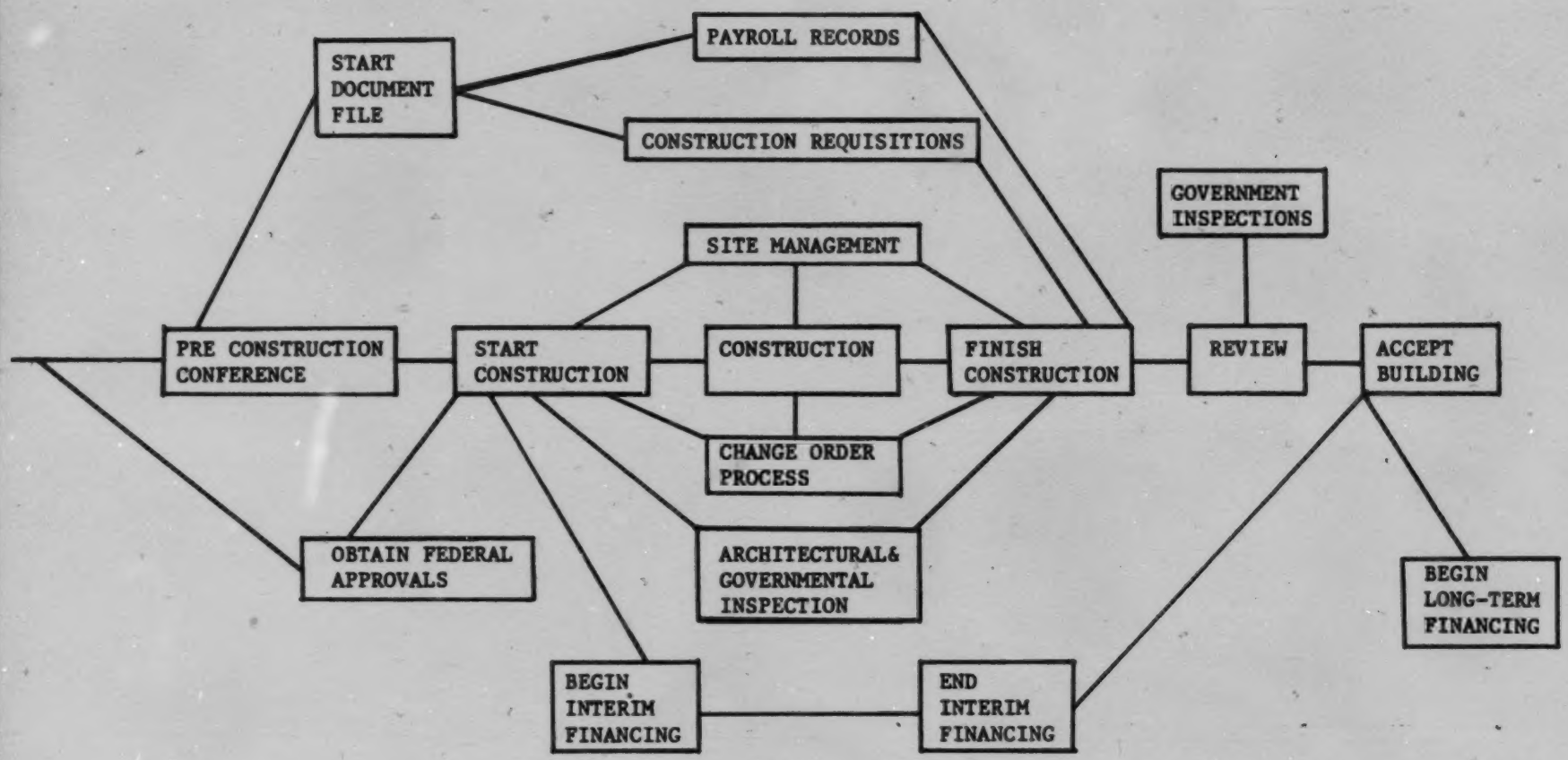

TRUSTEES REVIEW
START FURNITURE & EQUIPMENT SELECTION
REVIEW SPECIFICATIONS FOR PROJECT ACCEPTABILITY
AUTHORIZE DESIGN DRAWINGS
COMPLETE DESIGN DRAWINGS
EVALUATE ARCHITECTURAL FEASIBILITY
APPLY FOR FEDERAL ASSISTANCE
EVALUATE FINANCIAL FEASIBILITY
PRESENTATION OF FACTS TO SOURCES OF EXTRA-INSTITUTIONAL FINANCING


REQUEST WAGE RATES
FINAL COST ESTIMATION
PREPARE BID DOCUMENTS
ADJUST BID DOCUMENTS
PRE-BID CONFERENCE
FORMALIZE FINANCIAL ARRANGEMENTS
ADVERTISE BIDS
BIDS RELEASED
FEDERAL REVIEW
BIDS OPENED
EVALUATE BIDS
TRUSTEES REVIEW
REBID OR AWARD CONTRACT
ADJUST FINANCIAL ARRANGEMENTS
NEGOTIATE FEDERAL ARRANGEMENTS


START DOCUMENT FILE
PAYROLL RECORDS
CONSTRUCTION REQUISITIONS
GOVERNMENT INSPECTIONS
SITE MANAGEMENT
PRE CONSTRUCTION CONFERENCE
START CONSTRUCTION
CONSTRUCTION
FINISH CONSTRUCTION
REVIEW
ACCEPT BUILDING
CHANGE ORDER PROCESS
OBTAIN FEDERAL APPROVALS
ARCHITECTURAL& GOVERNMENTAL INSPECTION
BEGIN LONG-TERM FINANCING
BEGIN INTERIM FINANCING
END INTERIM FINANCING

INSTITUTIONAL LONG-RANGE PLANNING: A PRE-REQUISITE FOR BUILDING

As mentioned in the Introduction, this manual is intended to assist college administrators to go step-by-step through new facility construction projects. This manual assumes, however, that at some point in the past the institution has hammered out an institutional long-range plan and/or facilities master plan. Since the final efficiency and effectiveness of facility project completion is predicated upon the planning process and formal adoption of institutional objectives, a brief overview of planning processes is included in this chapter of the manual.

One succinct definition says that "Planning is the process of preparing a set of decisions for action in the future, directed at achieving goals by optimal means." This definition, however, leaves us hungry for more information. Robert G. Smith, in his 1969 research program College and University Planning,[1] takes a more descriptive, and therefore more useful, approach to the definition: "Planning implies a structured strategy, resulting from the conscious use of intelligence to anticipate the future; to order action; and to coordinate efforts to get more of what we want from the available resources than would otherwise be possible."

"Regardless of whether we are talking about forward planning, long-range planning, projective planning," continues Dr. Smith, "planning is still the device of trying to get down in some meaningful way all of the parts of a system so that we can see or

predict the effects which will occur in any one part if any other part is changed. Stated in another way, planning is an attempt to deal with a somewhat uncertain future by 1) establishing specific objectives; 2) gathering data to quantify objectives; 3) using this information to formulate broad strategies and specific programs which are based on alternative ways of attaining objectives."

Planning then is a dynamic process, constantly going on, which has as its basic objective an explicit design for the future, a context within which to organize variables into some coherent pattern, a structured frame-of-reference within which future decisions can be made more effectively when the time comes to make them. Planning allows college administrators to get ahead of problems rather than catch up to them.

Most colleges plan to one degree or another. In some institutions the president creates and hands down the plan, in others a committee meets upon occasion to plan, in others a plan was once generated but since that time planning has occurred only at the program level. A long-range plan includes a total plan for an institution, including facilities, while a master plan has generally come to connote an extensive facilities plan. A master plan for facilities should be generated only out of a total long-range planning effort. If you have not entered into this process, carefully examine your new building needs: they may bear no relation to institutional objectives or to the future.

A proto-typical planning model in use at a small, church related college [2.] can be seen in Figures 1-3. A review of these diagrams, contrasting them to your own planning process, might provide useful insights into better organizing or integrating your planning activities.

If planning is to be effective, it will minimally include the following activities [3.] :

1. Organize for planning and establish responsibility. Planning can not be an off-the-top-of-the-head activity, it must be a formalized process, on-going in nature. Time and again it has been found that one of the earliest and most important payoffs in planning is the process itself, getting diverse people to work together. A planning organizational structure is suggested in Figure 4, including basic responsibility. Whatever organizational structure you choose, its visibility among all college constituencies will be desirable.

2. Describe the college. The second step in planning is to write down the descriptive facts about the college. Often, these facts -- covering characteristics of the student population; characteristics of the faculty such as salaries, education, and publications; the nature of the physical plant, and the state of the endowment -- are readily available. But the likelihood is that they have never before been systematically collected, codified, and analyzed. This study should be organized and conducted to answer the question "Who Am I?" in the greatest possible detail. Creating a plan forces a college to learn

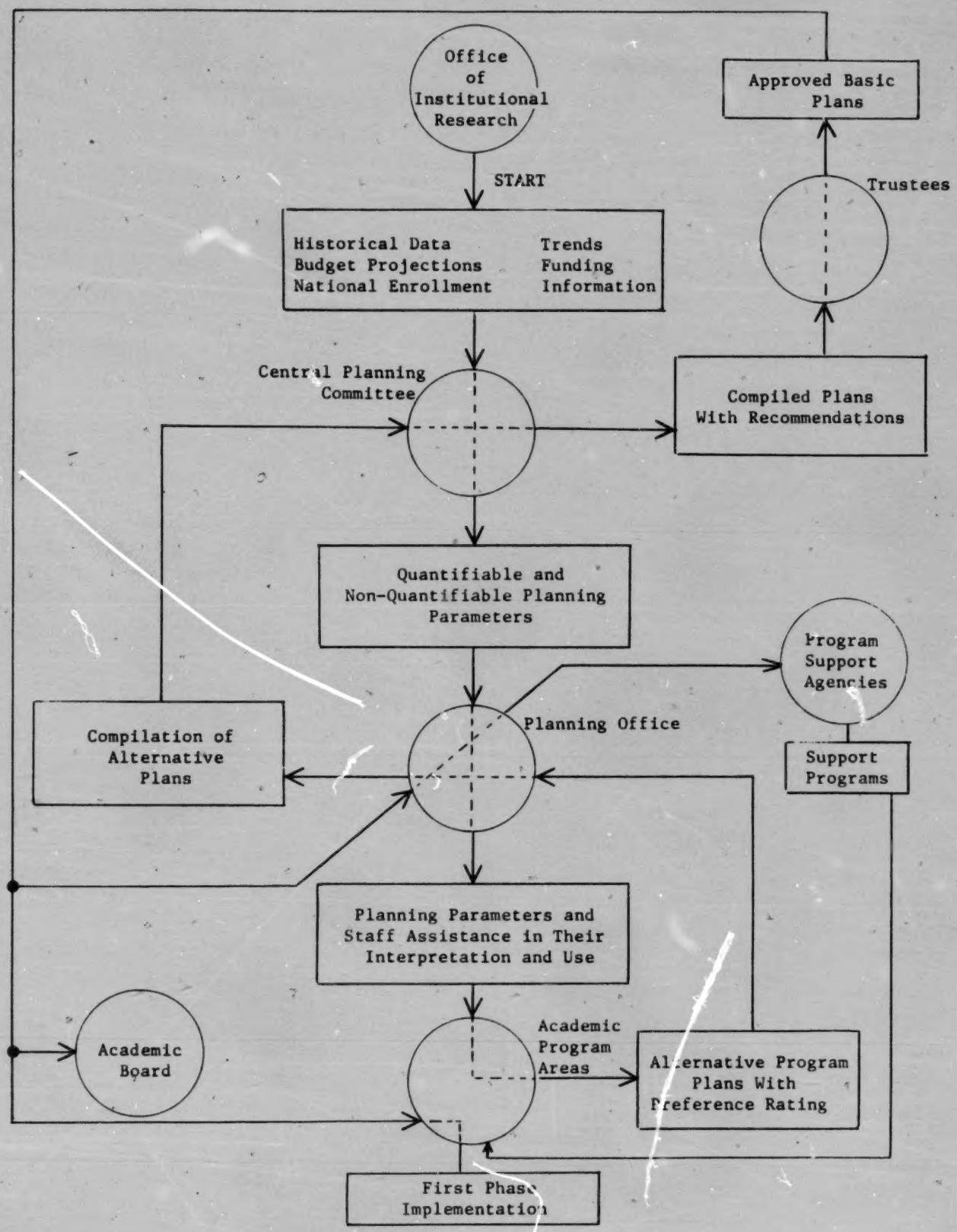


Figure 1 PRIMARY COMMUNICATION NETWORK IN GENERATION OF BASIC ACADEMIC PLANS

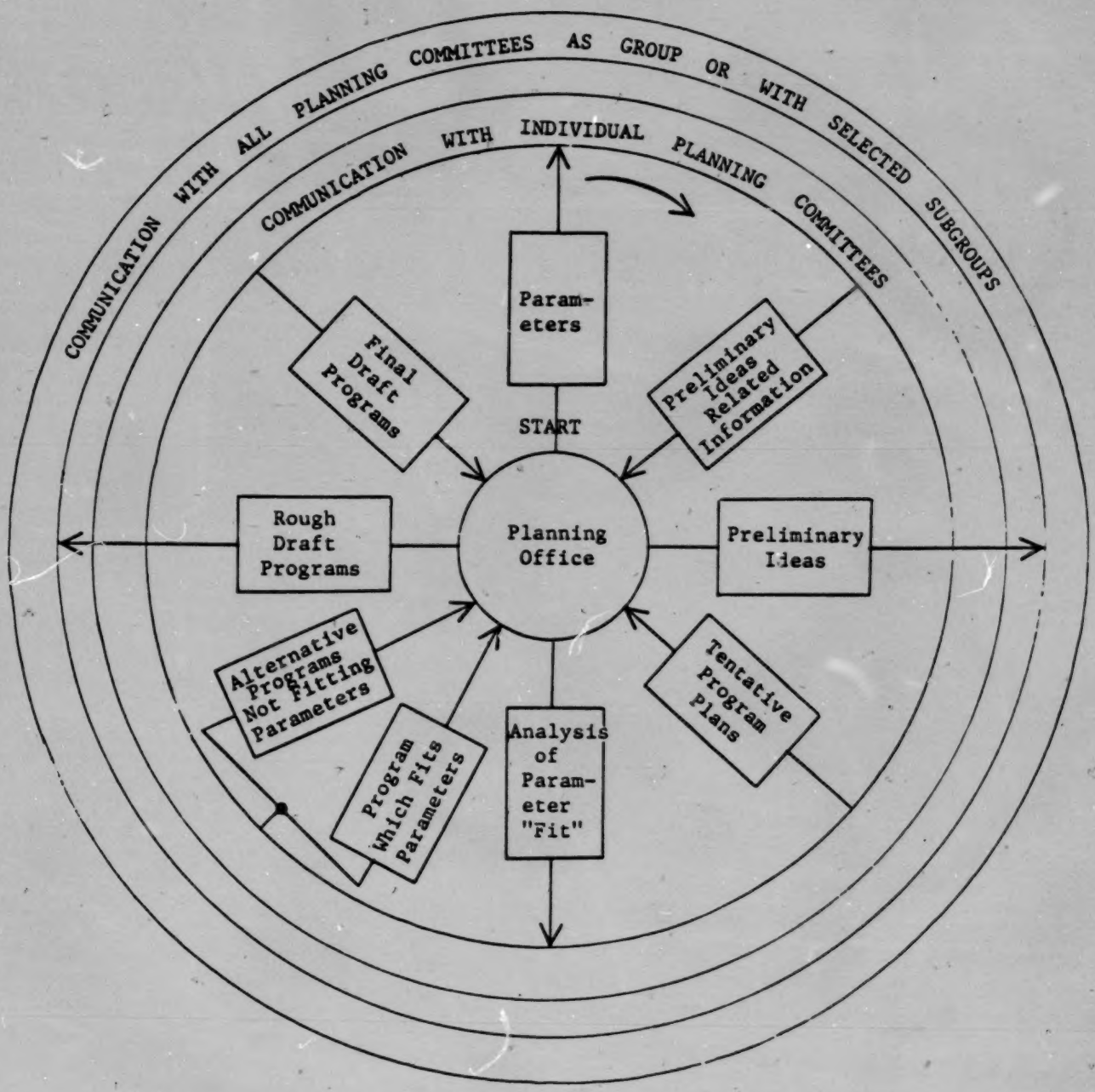


Figure 2 INTERACTIONS AMONG PLANNING COMMITTEES AND THE PLANNING OFFICE

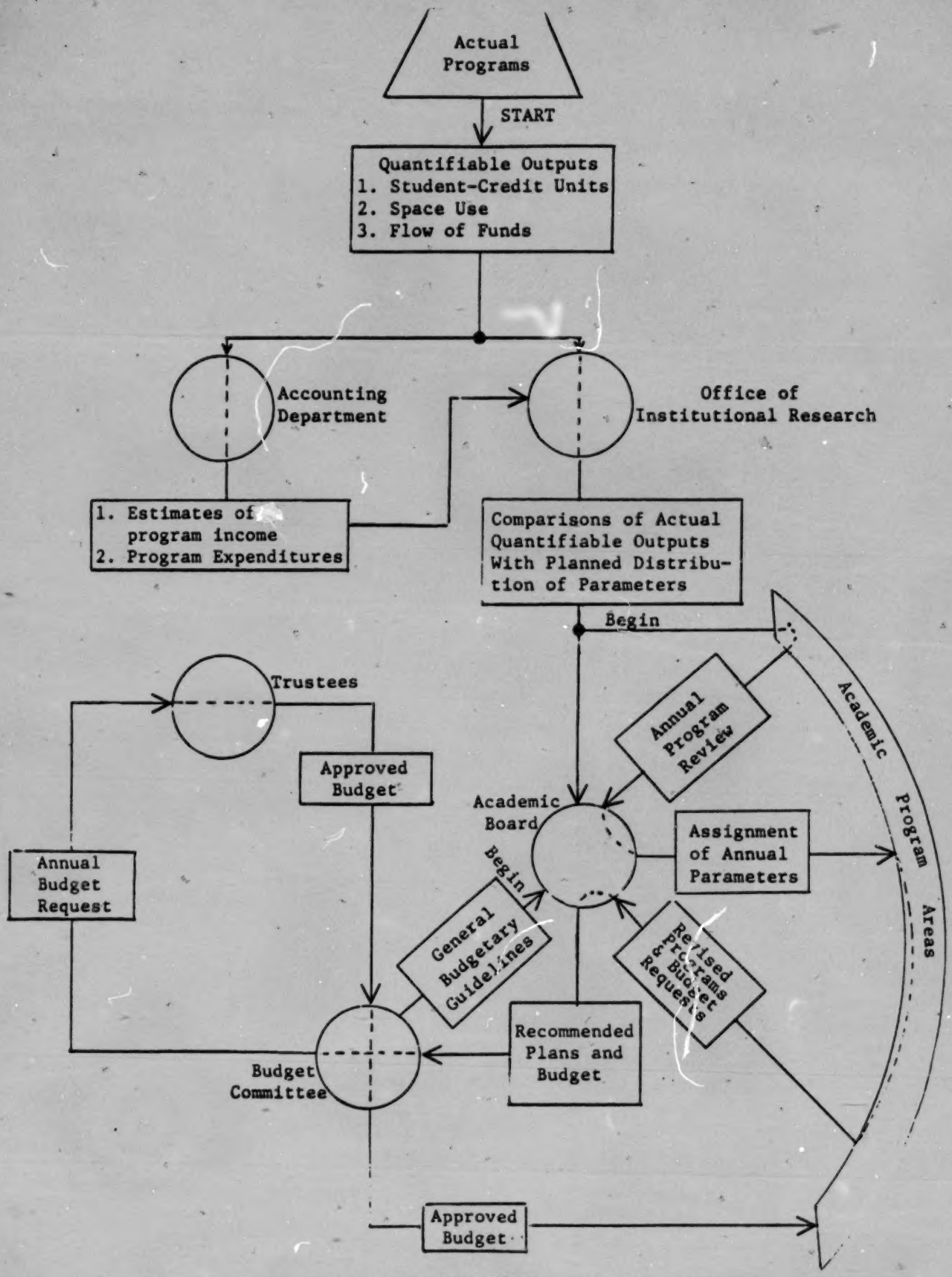


Figure 3 THE ANNUAL PROCESS OF REVIEW AND BUDGETING

about itself and its relationship to the changing world around it.

3. Clarify institutional goals. College catalogs abound with educational goals and objectives which are generally useless and are almost always cliches. The job of any planning effort is to go beyond these high-sounding and meaningless phrases and to arrive at a clear set of goals and objectives for the institution. The effort here is directed toward a definitive statement in answer to the institutional question: "Where do I want to go?" The statement would pinpoint the place of the institution in society, defined by its particular setting and orientation, as envisioned by the planners for ten to twenty years in the future.

4. Developing a set of assumptions about the future. There are two kinds of assumptions about the nature of the future: internal assumptions, involving developments over which the college can exercise substantial control, and external assumptions, which include social and economic changes over which the college can exercise somewhat less (or no) control. The process of positing, researching and formulating these assumptions forces the college to think deeply about the factors which will determine its future. It also places an institution in the position of having anticipated the future by formulating contingency plans.

5. Integration of all studies and analyses into a formal document. Hopefully, all constituencies of the college have had some part in the total planning process. After a thorough

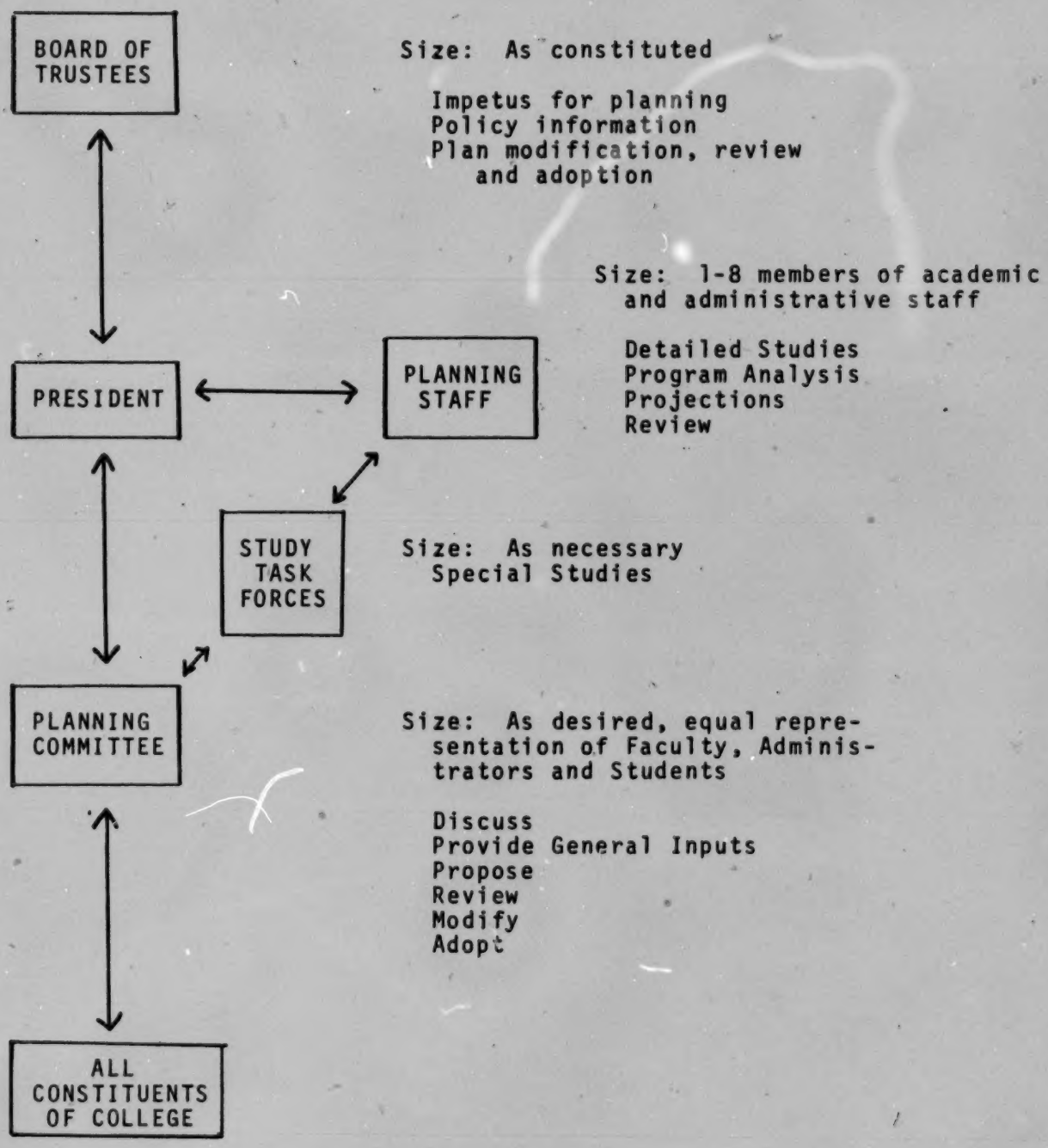


Figure 4 - PLANNING ORGANIZATION

review, from individuals to policy board, putting the plan into a formal and approved document allows everyone to see where the college is heading, whether it is deviating from its path, in an open and explicit manner. The end product -- the meshing of current descriptive data, goals, and assumptions about the future -- will provide the college with a useful and meaningful plan.

From successful planning efforts one key ingredient filters consistently. This filtrate is the commitment of the governing body and governing administrators of the institution to realistically chart the course of the institution and to be willing to operate the institution within the latitudes outlined by that course and also to maintain the flexibility to change that course by following the precepts set down within the plan. In other words, a firm commitment by those responsible for the governance of the institution to a plan.

A second key ingredient identified in the analysis of the filtrate is the operational importance of the development office. This office, working in concert with the president will be responsible for a great deal of the implementation of any plan and should be available to the planning group throughout the process so that its assessment of the probability of success in any given project associated with the institutional objectives may be offered in the project's embryonic stage. The development office will form the bridge between the completed planning document and the actual implementation of the programs contained therein.

The inclusion of the development office in the planning formula often assumes that this office is also responsible for the institutional research program.

The third ingredient of the filtrate is the inclusion of the entire institutional community in the planning activities. The inclusion must not be a token approach to participatory democracy but a realistic assignment of specific duties and responsibilities and a forum for direct communication between all the diverse groups within the community must be established and cultivated.

If you have sufficiently completed the planning process for the institution, you are ready to plan for capital improvements. As following chapters will describe in detail, planning capital improvements for an institution of higher learning is based upon need. "So simple a word ('need') entails a complexity of concerns," says John Millett, Chancellor of the Ohio Board of Regents. "First, need is necessarily related to purpose, program, and enrollment. Secondly, need is related to utilization of space. Thirdly, need is related to quantitative standards of space. Fourthly, need is related to qualitative standards of space. And in the fifth place, need is related to aesthetic impact upon capital improvement planning for a higher education enterprise."

At this point, let's recapitulate and review some of the basic assumptions we have made prior to the actual beginning of a

capital expansion program.

1. The particular building about to be built finds its reasons for being rooted in some sort of institutional plan.

2. The governing body that will authorize the institution to proceed with the activities necessary to finance and construct this building are familiar with the plan and position this proposed building occupies in relation to that plan.

3. Some sort of review of that plan was made to insure that this building is a concrete portion of that plan.

4. The organizational unit responsible for the activities to finance and construct this building is the development office.

5. The development office has done the necessary research to determine that this building program meets the criteria set forth in items 1, 2, and 3 above.

In order to maintain a sense of perspective, the office of the Director of Development has been chosen as the focal point of this manual. The procedures and personnel involved in the institutional planning process are therefore described and referenced from the vantage point and involvement of the development officer. Not every institution has an office clearly designated as the "Development Office," nor for that matter, is there a particular staff member uniquely charged with all of the associated responsibilities of that office at many institutions, but upon a close examination of the operational structure of any institution of higher education the functions of that office are indeed carried out.

RESEARCHING FOR BUILDING

The development office of an institution of higher education is normally charged with the responsibilities associated with implementation of programs involving capital expansion monies. Logically, this office should therefore, be included in, if not responsible for, the activities preceding the actual decision to implement a proposed program of capital expansion. The traditional role defined for the institution's development officer settles around fund raising, annual giving, capital appeals, deferred giving, foundation development and corporation support. However, in the emerging patterns of college and university management, the inclusion of this financial specialist in the preplanning and planning stages of a capital expansion project is becoming more common. The importance of federal assistance, especially since the mid-1960's, in the construction of new facilities has made the skills of the traditional development officer crucial to the success of many projects. In the larger universities the development officer may be made up of several operating sets of staff while in the smaller schools only a part-time administrator who also tends to the public relations classes and alumni association may be the whole development office.

Most of the concepts found in this manual refer to the development officer. That title, however, is not meant to exclude any particular individual or office that takes on the capital expansion programs. The most common alternate to the development officer is the Vice President for Fiscal Affairs, the Treasurer

or the Chief Fiscal Officer regardless of his title. The other likely individual for this development position is the Superintendent of Buildings and Grounds.

The planning office may be found in either the President's office or the fiscal office or in a combination of places. The point we are making is that some administrative officer will sooner or later take on the responsibility for the building project and this individual or office should be looked upon as the general developer. In the traditional hierarchial management systems, all too often the development man is called for a meeting where he is told "this is what we want to build -- now go out and get us the money."

Let's look a little more closely at one assumption alluded to earlier: "The inclusion of the development office in the planning formula assumes that this office is also responsible for the institutional research program." If the institution is fortunate enough to contain a free standing office of institutional research, the development office may not have this responsibility directly. It is, however, essential that the development office has articulated the particular questions that must be answered to the institutional research staff and that this staff completely understands all the ramifications that accompany a project of this nature. In many institutions, an organized and trained institutional research staff is not a working arm of the management organization. The burden of the work normally processed by this kind of office then falls on the

particular individuals in a project as a specific function of management or administration.

Regardless of which group actually does the work, some basic checkpoints must be covered: Do we really need this building? What should we build to satisfy the demand being placed on the institution? What, in fact, are these demands? Have these demands been verified? Have we planned ahead so that future demands or probable modifications in these demands can be accommodated? How much money do we have, will we have or can we get? Can we afford this project as it has been envisioned? What kind of verification system has been established to monitor any changes that might occur to the answers of the preceding questions?

It is the prime responsibility of the group of administrators whose charge it is to build this building to be as organized as possible to accomplish its task. Speed with accuracy must be the concern of this group. This is the age of inflation and it dictates that once the pertinent facts have been gathered and analyzed and a decision has been made, speed must be encouraged. The rate of inflation commonly found in the construction industries is fifteen to eighteen per cent per year. Translated to dollars the inflation rate becomes a race against the clock. For example, if a project estimated to be worth one million dollars is delayed by three months to organize a committee to discuss the appropriate class sizes to be accommodated in the new humanities building, the cost to the institution in increased

building costs is $37,500. This delay and its subsequent ripple effect on other decisions will result in the postponement of the bid process and that postponement will be reflected in the contractor's bids on the project. However, the other side of the coin is just as important. If those classrooms were designed too large, we end up with some underutilized classroom space and student stations at $30 plus per square foot, or if they were too small, we're in for some embarrassing remodeling or some expensive design changes if some of that speed catches up with us in time.

What is the happy medium? Let's go back and look at one part of the assumption - institutional research.

Institutional research will provide the first direct link between the institution's general master plan and an effective facilities plan. It provides the organized and analytical assessment of the institution's position in relation to its goals and objectives recorded in the general master plan. Much of this institutional research is already ongoing in an unorganized (or perhaps merely untitled) manner. The "institutionalization" of institutional research is a recent occurrence. Organizational units for this type of activity surfaced in some of the larger universities around 1920, but it was late in the 1950's that the term "institutional research" became to be a common entry in the education manager's vocabulary. However, the term "institutional research" may be an accurate description of the work that must be done by the "researcher." Much of his time is spent gathering

the information. Indeed, this position in education management has timed its arrival closely to the arrival of systems concepts in management and management information systems. In most institutions when these systems concepts were introduced, the quantity of data found in the institution quickly dictated the need for someone to organize it so that some sort of system could be established. An institution of higher education does not differ substantially from most other types of commercial and industrial organizations in terms of its need for basic operational information. Each operating entity within the organization is constantly generating data to allow it to operate and evaluate itself. For example, the registrar constantly builds files on individual students and analyzes groups of data found in these individual files. This analysis includes - but is not limited to - credit production, scheduling, forecasting and department-faculty course loads. The Building and Grounds Department must keep account of the facilities for which it is responsible including not only the buildings but the rooms within those buildings and the seats and laboratory equipment found within those rooms.

If we, at this point, interject the institutional research man to gather together the information cited in our two examples, we can see a logical second level of information being generated. By combining these pieces of information, we come up with some utilization figures which can be coupled with forecasts to predict a saturation point and the subsequent ramifications which

might precipitate a decision to build additional space or improve upon the efficiency of those using and scheduling the space. This, of course, is a very simplistic overview of the role and function of the institutional researcher, but many times the one-to-one interaction is the observable part of the process in which the institutional researcher plays the role of catalyst. This individual may not have been specifically titled Director of Institutional Research but may have been any member of the management team serving in this capacity in an ad hoc manner to verify or gather critical information needed to make a decision.

There are some basic detailed studies that should be completed either by the department office or by the institutional research office so that a reliable, accurate and current information pool is available in order that a base can be found for an effective facilities plan. Much of the data required for these studies as well as the information that these studies produce is essential for the day-to-day, semester-to-semester operations of the institution.

The common pitfalls that may be encountered in assembling some of this data stems from this very fact. The data that must be gathered is, in many cases, part of some office's operating report, so pay special attention to the definitions that accompany that data. In some instances, this may be the first time this data will be intermingled and this may present some analytical problems, however, this also might be a blessing in disguise. If some time is spent aligning the definitions used across the

institution, future reports of all types may be more consistent and meaningful.

Required information for baseline studies to be included in a facilities plan are:

1. Inventory of Existing Space - a building by building and room by room inventory of existing facilities.

2. Utilization of Existing Facilities - study and evaluation of existing utilization of classrooms and laboratories.

3. Utilization of Non-Teaching Facilities - study of present use and requirements for offices, research laboratories, public service facilities and other general academic requirements, including library space.

4. Estimation of Future Space Needs - development of techniques for estimating future space needs. Such a system would be used for each semester thus allowing immediate and constant checks on the system.

5. Quality Study of Existing Space - building by building analysis to examine the condition of existing space. This activity can be used to determine the appropriateness of the scheduling patterns and as an early scheduling device for normal and preventive maintenance.

6. Residential Housing Study - development of data on the present and future demands for residential housing.

These studies should be considered vital prerequisites for any facilities planning. As you can see from the brief description, they not only cover the "hard" data found in the facilities office but much of the "soft data" found in the registrar's office, the admission's office and in the academic dean's office. Considerable attention should be given to the implementation of these types of studies on a regularly scheduled basis.

One critical fact that needs to be recognized is that this type of analytical activity does not become meaningful without an extensive and consistent historical baseline. Therefore, the definitions used to quantify the data should be well thought out and should be usable by as many operational groups and sub-groups as possible within the institution. Also, for specific projects requiring information for a discussion in the immediate future, a series of studies such as the ones mentioned above should be done for the years immediately preceding the current academic year. This type of project often takes a concerted effort to dig back into the files to assemble the data base. Each of the six types of studies mentioned above will be examined in the following portion of this manual:

Facilities Inventories - Inventory of Existing Space

This inventory is the most basic of tools to be used in the formulation of a facilities plan. The information in this document must be complete and it must be accurate. The data contained in this document will be called for in isolated or tabular form for nearly every analytical description or forecast that the institution will make. To underscore the importance of this data, the United States Office of Education has spent millions of dollars assisting institutions to inventory their existing facilities. The tremendous weight placed upon this data has resulted in the formation, in 1970, of a special division within the national association of Executive Directors of Higher Education Facilities Commissions. This division formed into a non-profit corporate structure known as Higher Education Facilities Service,

Incorporated, collects, edits, verifies, audits and transmits to the National Center for Educational Statistics inventory information supplied by every institution of higher education in the United States and its Territories.

The information that each institution supplies is their response to the Higher Educational General Information Survey (H.E.G.I.S.) reported on OE Form 2300-7. This form is now sent directly to the state Facilities Commission instead of to Washington. In New Hampshire, it is sent to Mr. Albert Hall, Executive Secretary, New Hampshire Higher Education Facilities Commission, 875 Elm Street, Manchester, New Hampshire 03101.

The H.E.G.I.S. form that is used to send this information on to the Federal Government is an extremely useful method of summarizing the institution's physical plant inventory. If all the homework has been done to accurately fill out that form, the institution is well on its way to maintaining a complete inventory. If by chance some of the source data for that form has been misplaced, the Commission has in its files print-outs and punched computer cards containing room by room information from an inventory it assisted your institution to make in 1967-68. These print-outs and duplicate cards are available from Mr. Hall and are an excellent source manterial especially for updating to a current inventory.

The following kinds of information makes up the three levels of inventory information that should be kept current at your institution; these are: land, buildings and rooms.

LAND - an accurate account of the amount of land owned, controlled, or used by the institution should be maintained. Detailed maps and topographical studies are, of course, useful documents but certain types of tabular information should also be on hand. The legal control of the land is of prime concern and the categories of control are as follows:

1. Owned by the institution in Fee Simple Absolute

2. Owned by the Institution in Fee Simple Absolute but with limitations and encumbrances. These limitations may include reserved life estates or reserved use attachments as part of a gift or bequest. The encumbrances may include such things as power line easements, proposed highway rights of way, municipal open space provisions or sewer easements.

3. Owned by the Institution with Restricted Disposition. This may include lands whose title rests with the institution but is subject to mortgage conditions.

4. Leased property

In addition to control and location of the land which is of prime concern to the facilities planner, the following categories are representative of the type of information that should be recorded:

1. Main Campus including all land with contiguous boundaries.

2. Main Campus land within one mile (but not contiguous with the main campus).

3. Satellite lands serving the main campus outside the one mile limitation.

4. Branch campus or extension division land with the same types of categories mentioned above.

5. Other land held by the institution.

The costs of the land are also important data. Where possible, the costs should be identified by tract and the year the costs were incurred. In the case where land was bought with financing other than direct lump sum payment to the previous owner, be sure to include all financing charges including mortgage interest, real estate fees and legal fees. The cost information should be updated when new estimates are available and if a regularly scheduled appraisal is not conducted one should be arranged. Book values should be kept current as this becomes an integral part of any type of conventional financing program. In addition, estimated costs of lands adjacent to any parcel should be kept on file.

In addition to the legal and financial description of institutional lands, any physical description of the land held in the institution or by architects or contractors involved in previous development work should be accumulated and organized by tract. This information can include such things as topographical studies, subsurface conditions (ledge locations, ground water tables, boring reports and underground utilities locations) and the location of permanent structures and markers in "as built" documents.

BUILDINGS - every building owned or used by the institution should be included in the inventory. The buildings owned by the institution will have, in some cases, pertinent information other than buildings leased by the institution for specific functions or times. The Office of Education of the Department

of Health, Education and Welfare has developed a manual entitled "Higher Education Facilities Classification and Inventory Procedures Manual," Document No. OE 51016. This document provides a complete set of instructions and definitions for an institutional facilities inventory. This manual should be on your campus as it was used by the State Facilities Commission to inventory your campus in 1967-68.

Building Data - (Financial) - each building should be uniquely identified by the institution with an unduplicated building number as well as a name. The Date of Initial Occupancy refers to the date the institution took control of the building either from the contractor who constructed the building for the institution or the date the sale or leasing agreements allowed the institution to take control. The Actual Capital Investment by the institution required to take control of the building should be recorded. This figure should include all costs associated with the purchase or construction of the building including construction costs, architectural fees, financing fees, capital improvements, legal fees, etc. The Estimated Replacement Value is also an essential piece of information. This calculation can be based on the full insurable value of the building or on unit costs for similar type of construction currently under construction or recently completed. Whatever calculation is used, be sure to record the type of calculation and to take cognizance of the ever present and ever increasing inflation rates present in the construction trades industry. The Construction Cost

used to determine the Actual Capital Investment should also be separately recorded. This fact, when adjusted to current dollars, can be used to estimate the cost per square foot for similar types of contemplated construction on your campus. The Source of Funds to build or acquire each building is also useful information.

Building Description - this section should include a general description of the building particularly as to its campus function, e.g. science building, classroom-administrative building, computer center. The Gross Square Feet contained in the building should be recorded. For older buildings where detailed architectural drawings are not available, the calculation of gross square feet may be obtained by using the buildings' outside measurements times the number of building levels. The building should also be broken down to display the types of Assignable Square Feet available. This display is merely a tabulation of square footage arranged by the functional academic room types as described in the Office of Education Inventory Manual previously cited. In addition to Assignable Square Footages, Custodial Circulation, Mechanical and Dead Storage areas should be calculated and recorded.

The Type of Construction should be recorded such as wood frame, steel reinforced concrete, high rise, etc., as well as the name of the architect and the general contractor. Finally, the current Condition and Status of the building should be maintained as part of its permanent record. Condition and Status should

include the physical condition of the building, e.g. structural fire rating, heating and cooling systems, roof, major maintenance records, etc., and the life expectancy of the building should be calculated taking into consideration and recording major planned maintenance and renovation programs.

ROOMS - each room within each building should be considered a functional unit and accordingly specified, detailed and accurate information describing that unit should be maintained. Each room should be assigned a unique identifying number, possibly linked with the building identification code. The Assignable Square Feet found in each room (with the dimension of that room if possible) should be recorded. If the room is permanently or temporarily assigned to an organizational unit within the institution (e.g., administration, instruction, research, public service, auxiliary enterprises, extension, etc.), this assignment should be noted. For the purposes of H.E.G.I.S., these organizational units are:

CODE	DESCRIPTION
1000 - 4999	Instruction & Research Departments Organized Activities Organized Research Public Service
5000	Library
6000	General Administration & Institutional Services
7000	Auxiliary Services
8000	Non-Institutional Agencies

The number and type of student stations or teaching stations should be reported for each room. An extremely useful set of information is the design capacity for each room as well as the number of stations that are actually present within the room.

Each room should be classified by its designed or used function, for example, classroom, laboratory or office. Again, we go back to the Office of Education's Inventory Manual which contains virtually every possible type of room and a complete definition of each type. For example:

100 CLASSROOM FACILITIES

110 Classroom

Definition: A room used by classes which do not require special purpose equipment for student use.

Description: Included in this category are rooms generally referred to as lecture rooms, lecture-demonstration rooms, seminar rooms and general purpose classrooms. A Classroom may be equipped with tablet arm chairs (fixed to the floor, joined together in groups, or flexible in arrangement), tables and chairs (as in a seminar room), or similar types of seating. A Classroom may be furnished with special equipment appropriate to a specific area of study if this equipment does not render the room unsuitable for use by classes in other areas of study.

Limitations: This category does NOT include conference rooms, auditoriums or class-laboratories. Conference

rooms are distinguished from seminar rooms on the basis of primary uses; a room with tables and chairs which is used primarily for meetings (as opposed to classes) is a Conference Room. Auditoriums are distinguished from lecture rooms on the basis of primary use; a large room with seating oriented toward some focal point which is used for dramatic or musical productions, or for general meetings on an Assembly Facility (i.e., an auditorium normally used for other than scheduled classes). Class Laboratories are distinguished from Classrooms on the basis of equipment in the room and by its limited use; a room with specialized equipment-drafting tables, musical equipment, (instructional) laboratory benches, typewriters, desk calculators, shop equipment, etc., which is used for instructional purposes is a Class Laboratory.

A definition of this degree of completeness is available for each of the following types of rooms:

100 CLASSROOM FACILITIES

- 110 Classrooms
- 115 Classroom Service

200 LABORATORY FACILITIES

- 210 Class Laboratory
- 215 Class Laboratory Service
- 220 Special Class Laboratory

225 Special Class Laboratory Service

230 Individual Study Laboratory

235 Individual Study Laboratory Service

250 Nonclass Laboratory

255 Nonclass Laboratory Service

300 OFFICE FACILITIES

310 Office

315 Office Service

350 Conference Room

355 Conference Room Service

400 STUDY FACILITIES

410 Study Room

420 Stack

430 Open-stack Reading Room

440 Library Processing Room

455 Study Facilities Service

500 SPECIAL USE FACILITIES

510-515 Armory Facilities

520-523-525 Athletic - Physical Education Facilities

530-535 Audio-Visual, Radio, T.V. Facilities

540-545 Clinic Facilities (non-medical)

550-555 Demonstration Facilities

560 Field Service Facilities

590-595 Other Special Use Facilities

600 GENERAL USE FACILITIES

610-615 Assembly Facilities

620-625 Exhibition Facilities

630-635 Food Facilities

640-645 Student Health Facilities

650-655 Lounge Facilities

660-665 Merchandising Facilities

670-675 Recreation Facilities

690-695 Other General Use Facilities

700 SUPPORTING FACILITIES

710-715 Data Processing, Computer Facilities

720-725 Shop Facilities

730-735 Storage Facilities

740-745 Vehicle Storage Facilities

750 Central Food Stores

760 Central Laundry

790-795 Other Supporting Facilities

800 MEDICAL CARE FACILITIES

810-815 Human Hospital - Clinic Facilities

820-825 Human Hospital - Patient Care Facilities

840-845 Dental Clinic Facilities

850-855 Veterinary Hospital - Clinic Facilities

860-865 Veterinary Hospital - Animal Care Facilities

900 RESIDENTIAL FACILITIES

910 Non-Dormitory Residence for Single Persons

911 Dormitory or Residence Hall

912 One Family Dwellings

930 Multiple - Family Dwellings

080 UNASSIGNED AREA

081 Inactive

082 Alteration or Conversion

083 Unfinished

An inventory is only as useful as it is correct. A system for constantly reporting changes to keep the inventory current should be developed and used. This system can use manual notations on the room by room inventory noting modifications in the use, or arrangement of rooms, a change in control, or the addition of student stations. Basically, any change that affects the land, buildings or rooms of the institution should be recorded.

There are numerous types of computer applications that are available and can be easily phased into your inventory system. One of the earliest and most successful uses of computers was in the inventory field. One word of caution, however, - a computer can only successfully automate a system that already works in a manual mode. Much effort and many dollars have been needlessly wasted by institutions that chose to automate without having a workable manual system.

One example of the type of computing assistance that is available for inventory systems is the College and University Facilities Management package available from Computing Research Systems in Houston, Texas. The Facilities Management package consists of the computer programs, user's and operator's manual, data collection and preparation forms and two days of installation

assistance and instruction. The cost for this package is $5,000.00. Also available from this firm is an Instructional Analysis package for $5,000.00 and a Facilities Projection package for $3,000.00. The codes and definitions used by this firm's packages are the codes found in this manual and the H.E.G.I.S. forms. We must, however, remind you that this arrangement and the many other commercially available computer packages assume that the institution has inventoried its facilities and that some sort of inventory system is in use at the institution.

Utilization of Teaching Facilities

Once a complete inventory is available to the planning office the next step is to determine how the facilities represented by that inventory are being used. This particular portion of the research pattern is the most important. It is with this kind of analysis that the real impetus for construction is either proved or negated. The methods of measuring the utilization of teaching space are extremely varied, however, all contain the same basic objective - are we using our space in the most productive manner and in a manner reflective of our institution's goals? The use of any facility plan can, in most cases, be increased; however, there are certain constraints that must be imposed in order to stay within the operating bounds established by the academic standards of the institution. For example, state schools bound by state guidelines for square feet per student or cubic yards of air to be replaced in a given time

period may limit the number of student stations that can be placed in a particular classroom.

A useful kind of guideline for classroom utilization is observed in the airline industry. Through scheduling and class section manipulation most classrooms in an institution can be booked at nearly one hundred per cent occupancy. However, a forecasted utilization of one hundred per cent may not allow the academic flexibility so often strived for. When an airline plans its route schedule and its equipment use, the obvious goal is the maximum return on its investment, however, even in this highly profit motivated activity due consideration is given to the consuming public. Careful calculations are made to determine the number of passengers needed to support the cost of the flight and a particular piece of equipment is chosen on the basis of its capacity to generate that needed revenue plus the accepted profit margin. The expected demand on that flight is forecasted and schedules and equipment are chosen to best meet that demand. However, the equipment that is assigned is usually capable of carrying more passengers than the average demand factor indicates. A break-even passenger load will probably be established at 50% of the aircraft's seats, the demand forecast will range from 65% - 75% and an overload factor of 25% will be reserved. This overload is carried for a number of reasons but primarily to service unexpected clients in a manner that appears to be representative of personalized service. If a number of potential passengers are turned away, these passengers will seek

transportation on other carriers and will present future marketing problems and expenditures.

If the same type of constraints are thought out in the scheduling of classes and facilities in academic institutions, the teaching station demand can be arrived at as well as the break-even financial factors. In addition, a reserve supply of appropriate seats can be forecasted to minimize the number of disgruntled students finding the registration for one or more sought after classes closed to them for lack of space.

The first step in the process of measuring the utilization of existing facilities is the formulation of standards. These standards must be arrived at for each institution separately and they must reflect the institution's policy in these areas. The wide diversity of educational mission that is found among institutions of higher education prohibits the recommendation of any specific utilization study manual or methodology. There are, of course, several very complete and highly professional guides available to the campus planner. These manuals are extremely helpful but are designed to be used at a number of institutions and they allow the institutions to set their own levels of completeness or sophistication. The following documents are recommended for the guidance they offer in a detailed utilization study:

1. Manual for Studies of Space Utilization in Colleges and Universities, 1957. Russell and Doi, American Association of Collegiate Registrars and Admissions Officers, Ohio University, Athens, Ohio.

2. Higher Education Facilities Planning and Management Manuals, 1970, Western Interstate Commission for Higher Education, Planning and Management Systems Division, (Office of Education Contract No. OEG 0-9-150167-4534(010)

3. Space Utilization Manual - compiled by the Space Utilization Committee of the Association of Executive Directors of Higher Education Facilities Commissions and the Division of College Facilities, United States Office of Education. (This can be obtained through your State Facilities Commission and is complimentary to the Facilities Inventory Manual already mentioned)

The selection of these three documents was carefully made. They are the products of the most knowledgeable individuals in space utilization measurement techniques and there are many threads of commonality found in all three volumes. This list, however, is not meant to exclude any other methodologies for space utilization measurement.

The above references are not rigid self-contained methodologies, in fact, they underscore the philosophy that the existing diversity in American higher education is healthy and should be endorsed and nurtured. The philosophy found in the W.I.C.H.E. manuals stated in Manual I, Section 3.0, page 16 is indicative of the methodologies available to the user:

> "None of the procedures discussed in these manuals is so rigid as to endanger homogeneity forcibly or to preclude a place for institutional individuality. On the contrary, the procedures specifically call for input of institutional policy wherever such factors are appropriate."

We must emphasize that the purpose of a utilization study is not just a method for gathering enough data to set the institution's limits for maximum space usage. A completed utilization study

delivers to the planners and managers a measurement of the actual uses that are being made of their facilities. There may be a substantial difference between what the institution could support in the way of classroom use and what is actually observed, however, we must go back to the institutional standards. The utilization measured by a utilization study only represents the extent to which the various types of space available to the institution are being used. The optimum level of space utilization may represent that level which can be obtained if no governing parameters are employed, for example, the use of a computer may be measured on a twenty-four hour cycle at seven days per week but if there is staff only for an 18 hour day six days per week the optimum utilization level must be set at that lower level. Of course with more staff, this level can be raised but this requires a change in the parameters of operation and possibly a policy change as well. The optimum level of space utilization then represents the level of use which can be supported within the parameters established by the institution. This is the area which tends to breakdown some of the pure mathematical logic underlying the more simple utilization models. These all important parameters are more than likely not readily quantifiable but some judgmental values can be assigned to them and this is where the complete works found in the referred volumes becomes especially helpful and those institutional standards are indispensible.

The college or university space planner obviously does not have to limit himself to the procedures found in those volumes but

two things must be accomplished before any type of utilization measurements can be attempted. First, an inventory of space has to be available and second, some institutional parameters or standards must be articulated.

Preassessment of physical facility requirements is essential when initiating new or altering existing program activities in order to determine the indirect financial consequences of the program decision.

If the physical facilities data collection and analysis remain at the "after the fact" inventory and utilization stage, little incentive remains to continue the data collection and updating. As a consequence, institutions fail to reap the enormous academic and financial benefits for planning purposes which evolve gradually as the compilation of data, year to year, reveals the thrust of the institution.

Utilization of Non-Teaching Space

Historically, most of the utilization studies have been concentrated in the teaching areas and most conclusions regarding facilities usage were based on these studies. However, this can be very misleading because the proportion of space actually set aside for scheduled instructional activities can be as low as 15 per cent of the nonresidential space available to an institution and classroom space has been measured to range from 5 to 20 per cent of the total nonresidential campus space.

The measurement of non-teaching space utilization is just as important as teaching space measurement and the same types of assistance are available through the referenced volumes. It also is important to note some added factors that affect this type of space utilization. This type of space readily levels itself to sharing by the various departments and organizational units found within the institution. A careful look at the prorated assignments of this type of space warrants special attention. It is in these areas that "empire builders" most often gain their footholds; for example, office complexes, special research areas and specialized library areas.

Estimation of Future Space Needs

The natural outgrowth of utilization studies is the formulation of models to determine the future space requirements for an institution. Again there are a great many methodologies that can be used for these projections. All the methodologies depend on the inventory and the utilization data and the institution's operating parameters must be included in the reasoning. The W.I.C.H.E. collection of manuals is a most complete collection of estimation techniques but there are many others not included in that document. No matter what procedure is used, the base data that is necessary can be found in the institution's inventory and utilization records. For example, we have chosen a relatively simple method of projecting instructional space requirements which did not come from the three volumes cited but is indicative of some of the excellent guides available to individual institutions.[4]

A USE-EFFICIENCY MODEL FOR PROJECTING INSTRUCTIONAL SPACE REQUIREMENTS

1. Average number of class periods per week that the various types of classrooms are scheduled,

2. Percentage of student stations actually occupied in the classrooms during class periods scheduled,

3. Square feet of area per student station, and

4. Class contact hours per week per full-time equivalent (FTE) student.

The objective of these statistics is to enable the institution to compute the net assignable area in square feet required per FTE student. Once this is accomplished, it is simply a matter of multiplying projected enrollment in terms of FTE students by that area in order to determine the total area needed for classroom instruction. The determination of area per FTE student can be performed in steps as outlined below. Calculations for general classrooms and teaching labs should be performed separately.

Let R = Room Periods - the average number of class periods that a typical room is used per week.

Let O = Occupancy Ratio - the average per cent of student stations actually occupied during a room period of use.

Let S = Station Area - the average square feet of area per student station.

Let H = Class Contact Hours - the average number of hours per week spent in the classroom by the typical FTE student.

<u>Step 1</u>. Determine the (average) number of periods per week that rooms are to be scheduled. This is variable (or factor) <u>R</u>.

Step 2. Determine the percentage of stations that can be filled during a period of room use. This variable O.

Step 3. Determine the desired area per student station. This is variable S. It would be simpler to include an amount to cover related classroom service areas (such as supply storerooms, audio visual equipment rooms, etc.) in this factor rather than add a separate calculation later.

Step 4. Determine the class contact hours per week (sometimes called "student station periods of occupancy") that the average FTE student will spend in the classroom. This is variable H.

Step 5. Derive the area in net assignable square feet per student class contact hour (or per student station period of occupancy). We will call this variable the "utilization area," UA. It is derived from Steps 1-3 as follows:

$$\frac{S}{RO} = UA \qquad (1)$$

Step 6. Derive the area in net assignable square feet required per FTE student. We will call this variable the "student area," SA. It is derived from Steps 4-5 as follows:

$$H(UA) = SA \qquad (2)$$

To summarize, formulas (1) and (2) will provide the net assignable area per FTE student that must be provided in order to conduct classroom instruction. Once that figure is derived, as in formula (2), it remains only to multiply the projected FTE student enrollment in the institution, college, or department to arrive at total classroom instructional space required. Formulas (1) and (2) can be combined, if desired, resulting in an alternate formula:

$$\frac{HS}{} = SA \quad (s)$$

It should be pointed out that there are other steps involved before the total related construction area can be determined. For example, circulation areas and physical plant service areas such as hallways, restrooms, heating and cooling equipment rooms, custodial closets, etc., must be provided in the overall construction plan. Frequently, these areas are calculated by a percentage add-on process. It should be noted that other types of areas considered instructional-related, such as faculty offices, secretarial/clerical, and supply rooms, are not included in the model. These latter, along with the circulation and service areas mentioned above, are outside the scope of the present discussion.

Tables can be constructed in order to facilitate selection of factors appropriate to the individual needs of an institution. Tables facilitate construction of fairly-simple computer simulation programs.

Such tables are:

1. Station Occupancy Matrix - which shows the average occupancy of a student station based on a reasonable range of scheduled room periods and percentages of occupied stations.

2. Utilization Area Matrix - which shows the square feet of area required per student class contact hour (or per student station period of occupancy), based on varying assumptions as to desired area per student station and station occupancy values (from Table 1).

3. Student Area Matrix - provides the area required per FTE student.

An important advantage of the model presented here is that it is simpler and faster to use than other, more complex, techniques developed in recent years. Once the four utilization factors are determined, the process is one of applying two simple formulas, from which tables of values can be constructed for convenience. Another advantage is that identification of the four distinct factors permits the involvement of faculty and academic administrators in a decision process which too often excludes such personnel and the intervention of important instructional philosophy considerations. Such involvement is particularly crucial in Steps 1 and 2, since departmental scheduling and faculty workload are directly involved.

Quality of Existing Space

The physical conditions of the facilities housing the various activities that were studies in detail in the utilization analyysis is the next key ingredient in the formulation of the institution's master facilities plan. Traditionally, the approach to

this kind of analysis has been "when the building can't be repaired any more, we build a new one." The more logical approach is to systematically review the facilities with a form of quality analysis or maybe more correctly - value analysis. Clearly, this kind of review requires a professional set of judgments provided by an individual experienced in engineering and construction. However, a set of guidelines must be established so that this review will be kept on a standard plan and not depend entirely on the judgment of the individual conducting the review. Each facility should be graded in terms of either its structural ability to accommodate the programs scheduled within it or for its suitability to be remodeled to accommodate future scheduled programs. Basically, we are talking about two specific types of review: 1) the general condition of the building, and 2) the feasibility of renovating a building to house programs not currently scheduled within that building. The first type of review is a regularly scheduled type of analysis similar to the routine used to establish periodic preventive maintenance schedules. The second type of review is the ad hoc process of determining the adaptability of a specific building to a current development program. In the first type of review the impetus for a capital expansion program can come from the analysis, while in the second case the impetus for the capital expansion program has originated in the academic section and the analysis will determine the buildings' suitability for change and/or modifications.

In both types of review there should be three major components: 1) Physical condition of the structure, 2) Aesthetic value of the structure, and 3) Cost/benefit analysis of the structure.

The Physical Analysis is perhaps the most obvious portion of the Quality Analysis. The building can be divided into its major structural components and these components can be mechanically measured for soundness and strength; room sizes can be measured and student stations or circulation areas can be accounted for by the institution's Buildings and Grounds Department or consultants. The systems to be analyzed in this portion are clearly visable areas and each system can be rated as either satisfactory or unsatisfactory. A good deal of this work is done when the buildings are periodically inventoried or scheduled for preventive maintenance. Obviously, various gradients can be used thereby placing the building into a remodel or demolish category.

The Aesthetic review moves into the intangible factors surrounding the building. This area includes but is not limited to:

a) location - especially in view of any future land use plans;

b) the environment of the building - for example, you might not want to convert a building to a library if it is adjacent to the institution's noisy central heating plant;

c) historical importance - demolition of the college's oldest building built solely from alumni contributions would have to be weighed against alumni sentiment;

d) adaptability - is the building suitable for the porposed function.

The Cost/benefit Analysis of the building should take into account the probable costs of demolition or remodeling. The remaining life cost of the building is also an important consideration especially for older buildings with high maintenance and operating costs. It may prove to be more economical to demolish a building and construct a new one rather than remodel the old one especially if the life expectancy of the building is too short to profitably amortize the remodeling costs. A compounding factor in this case can be the higher maintenance and operating M & O costs which can be offset by new construction and the following building efficiency found in the new building.

The order in which the three components of the Quality Analysis were presented is the order of investigation. If the Physical Condition of the building lends itself to remodeling or renovation and the Aesthetic review presents some desirable or allowable alternatives then the cost analysis can be undertaken. If certain cost indications appear to be extremely desirable and the physical analysis indicates a feasible project while some obvious aesthetic problems are present, it is suggested that detailed cost estimates be obtained. The savings may be of such magnitude to offset the aesthetic problems and in some cases these savings may be applied to solving the aesthetic problems.

Residential Housing Study

The housing facilities of an institution of higher education is in many cases an extremely important determinant of its financial stability. With the exception of the schools with a primary commitment to the commuting student, such as public community colleges, the availability and quality of housing directly affects the size and characteristics of the student body. This statement is obviously more valid for the rural or suburban institution than it is for the urban campus. The growth of an institution is measured by the size of its student body as well as its academic programs and the success of its graduates. In an urban environment the area surrounding the institution can absorb the increasing numbers of students to a certain extent. This spill-over effect has its problems but the time delay factor for the surfacing of these problems in many instances allows the institution to take remedial action. For the rural school the inability to house new students and the lack of conveniently located non-college housing effectively limits the ability of the institution to attract new students. In addition, the quality of the housing directly affects the attrition rate and indirectly affects the growth of the institution. Converely, the over abundance of housing facilities directly affects the growth of the institution. The overhead costs related to these facilities remains bearly constant, occupied or vacant and the institution has probably already budgeted the income from these auxiliary enterprises for academic purposes.

We begin to observe a fundamental planning and budgeting cycle here that directly affects the fiscal stability and academic flexibility of the institution.

There are many arguments, pro and con, on the construction and operation of college housing. Many administrators insist that it is merely an unwanted necessity; however, there are many real estate investors and development corporations eager to become involved with providing this unwanted necessity. The numerous financial arrangements, such as lease-back structures offered by many firms are indicative of the potential revenue to be earned by these facilities and their owners or operators. The traditional arguments seem to center on the magnitude of the financial commitment necessary to provide student housing while the demand for the institutional dollar from the academicians continues to grow. The management or administration of most institutions are trained academicians and can more easily plan and operate within the academic sphere. They more readily understand and appreciate the development of new curricula and programs and are therefore more likely to concentrate their efforts in these areas. The stigma of empty dormitoies lies heavily over many institutions - unsuccessful curricula can be eliminated by reallocation of staff and equipment but what do you do with an empty room? This question gathers more relevance with the changing life styles of today's students and the increasing economic squeeze. But let's go back and examine the intracacies of providing sufficient student housing.

An institution of higher education in order to educate students must be able to deliver its education to its students. The classrooms, laboratories, libraries, athletic fields and assembly areas, and the faculty that use them must be accessible to the student. The number of students necessary to support these facilities and personnel is usually found to be greater than the number of students located in the immediate area of the school, therefore, accommodations usually have to be provided by the institution. If your institution does not wish to rely on the surrounding community to provide student housing, the following questions must be answered:

Who is to be housed?

1. What percentage of the following kinds of students should be housed:

   a) undergraduate single males (upper classmen)
   b) undergraduate single males (lower classmen)
   c) undergraduate single female (upper classmen)
   d) undergraduate single female (lower classmen)
   e) undergraduate married students (with children)
   f) undergraduate married students (without children)
   g) graduate single males
   h) graduate single females
   i) graduate married students (with children)
   j) graduate married students (without children)

2. What percentage of faculty should be housed?

3. What is the demand for the above type of housing?

4. What type of housing should be provided?

5. Where should the housing be (on campus or off campus)?

6. What controls will the institution have over both on and off campus housing?

7. What kinds of financing is available for housing?

8. What kind of competition does the community present to the institution?

9. Can the institution charge competitive rates for their housing?

10. Can the institution afford to build and operate the type or style of housing demanded by students and faculty?

College housing unlike college education is, in many instances, a highly competitive phenomenon. A student may choose his institution on the basis of academic excellence but his loyalty to that institution is tempered by his financial limitations. Sacrifices are more easily made in living accommodations by the student especially if his life style does not insist on a controlled social environment. It is very common for students to accept substandard living conditions forced on him by the inability of his institution to provide him adequate housing. However, given the same options available to him off campus, most students would prefer to live on campus.

Let's take a look at some of those off-campus options. The housing is probably apartments or tenaments - the social regulations are usually only those covered by state and local laws; the number of students sharing common facilities (bath and eating) is usually very small; eating arrangements are left to the students discretion. These kinds of options can present delivery problems to the institution unless the institution's policies fall into two categories: a) <u>in loco parentis</u> will be strictly enforced, or b) the institution builds what is available off campus and consents to operate these facilities with the detachment of commercial real estate operators. Whatever the case may

be (and there is much gray area between the two extremes), there must be a clearly stated policy so that needs and demands can be assessed and the proper mix of accommodations provided. The policy of the institution directly governs the number of students to be housed and the type of facilities necessary for the housing.

The traditional dormitory philosophy (featuring rules and discipline) has become an enigma to today's students thus forcing some rethinking on the part of institutional administrators. Traditional dormitories with their double loaded corridors, gang toilets and sterile lobbies are no longer desirable accommodations in most instances. This point is underscored in the funding announcements used by the Department of Housing and Urban Development's College Housing Program. H.U.D. strongly encourages institutions to consider building apartments or suite type living units and discourages applications for financial assistance from institutions proposing traditional dormitories.

Once the institution's policies on the number of students to be housed are formulated and the type of facilities to be provided is determined and the social regulations have been aligned with the institutional philosophy, cost considerations must be analyzed. Can we deliver the type of housing planned by the institution and requested by the users? With the exception of the extremely remote rural institutions and the institutions that require students to be in residence on the campus or in college controlled housing, institutional housing is in direct

competition with the commercial enterprises found in the surrounding community. If the institution expects to fill its housing units, these units must at least offer relatively the same options as the competition. The institution must play the role of developer and attempt to deliver the best product with the lowest user price. All the methods of real estate development are applicable here while some of the uncertainty of speculative real estate development is tempered by the institution's ability to accurately forecast enrollment patterns. The fact that many developers of apartment complexes center their activitities around educational institutions seems to indicate a substantial profit situation is present.

FINANCIAL ANALYSES FOR BUILDING

Initial impetus for a building program generally stems from one of two sources: 1) the master plan indicates a new facility was anticipated at some point in the past and is now due for consideration, or 2) current needs indicate a new facility should be considered. Neither of these stimuli have their origins, however, in the financial arena. Information gathered as a result of efforts described in previous chapters of this manual will determine the necessity and kind and amount of facilities on your campus. This information, however, will also provide the basic data necessary to anticipate the fiscal realities of a new construction program. Building purpose, classroom utilization and configuration, inventories of existing spaces, enrollment projections, and so forth all have their financial implications.

There is a real need for reflective thinking and appraisal in the time flow between the onset of building pangs and the determination to push for the architect's renderings, bidding and award of contract. Without doubt there must be appraisal of need. This may be divided into the gross need for the net assignable square footage, and the need for the square footage in terms of the programs to be provided for by such a building decision. One of the current "in" things for an architect to do is to call upon those who are proposed as the faculty users of a projected building to engage in what might be called a "flow of consciousness" approach to planning the components of the new building. The point of the process is that through such

unstructured outpouring of ideas, the architect may better capture in design what will be most useful and functional to the teaching style and objectives of the faculty involved. This is certainly a far cry from the earlier "pick the kind of building you want from the pictures" approach. It is freer of the "these are the limits on types of materials to be used" approach than we knew in an earlier day. Partly, this development is the product of new engineering know-how and doctrine. Partly, it is the product of new materials and ways to combine materials. Just as is the case with the automobile you buy today, hundreds of models and styles, coupled with scores of options, gives you a far different buying situation than the famous Ford dictum "you can have any color, so long as it is black." But far less well understood in building buying terms is the cost of those varying option combinations. The price label in the window of the new car has no counterpart in the buying of a building today. Yet it could have, and does have in more and more academic administrations. But the steps to achieving this condition with respect to new construction are not easily achieved. These achievements in cost/benefit knowledgeability are the product of careful attention to cost realities and careful attention to a system for project management.

For the reader who is more concerned with matching the brick used in "old main," there is nothing that learning about cost realities will do for the brick-matching disease, and even less that any presently known system of project management can do

for the malady. For the reader who is genuinely concerned with pre-planning inputs, there may be information of value. Obviously, no general treatment of a topic can possibly answer the specific problems of a given campus. The adaptation of the general proposition to the specific situation is the challenge facing each president and other administrator who undertakes a college building project.

Because costs keep rising in academic building construction, as in everything else, it has seemed most constructive to relate this section on cost realities to a major source of cost data in academic construction. This is the annual "Cost of Building Index" of College Management magazine. The tables and figures quoted in what follows are taken from the July 1970 issue (pp. cover, 10-12) and the June 1971 issue (pp. 7-11). Before considering the figures themselves, it may be useful to consider carefully the following quote from the 1971 Index:

> "One item - that doesn't show up directly in the index - but which continues to contribute enormously to rising construction costs is delay. Suggestions on ways to curb this expense - which can run into millions of dollars on a major project - are suggested in the articles on construction which follow this index material."

The readers of this report and analysis are urged to get and read the July 1971 issue for these articles referred to above, and to read the concluding segment of this writing on project management systems for other insights.

In considering cost realities, the dollar expenditures for materials, on-site labor, off-site labor must be coupled with

the interest rates for the bond issue, or the imputed interest rate the specific gift or endowment would have brought. Since the source and cost of the funds with which to build are even more various than the structures funded, we will leave out of the index the cost. Based on 1957-59 equaling 100.0 College Management reports:

College Building Construction Cost Index

1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
106.3	107.8	109.9	112.6	115.7	119.6	124.0	130.6	139.7	149.7	158.6

The major components of this index are building materials, on-site labor costs and off-site labor costs. The table on the following page gives the detail on building materials costs from 1961 through an estimate for 1971. No one material represents more or less of a bargain in index terms, yet there are significant differences in the way the index numbers have behaved over the past 11 years.

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
COLLEGE BUILDING MATERIALS	100.3	99.7	99.6	100.7	101.8	104.1	105.8	109.7	115.3	119.4	123.6
Stone, clay, glass products	101.8	101.8	101.3	101.5	101.7	102.6	104.3	108.1	112.8	118.2	123.0
Metals products	100.7	100.0	100.1	102.8	105.7	108.3	109.5	112.4	118.9	127.9	134.0
Plumbing products	103.4	100.5	100.5	101.8	104.7	108.4	110.4	114.1	118.7	124.2	129.0
Lumber products	95.8	96.5	98.6	100.6	101.1	105.6	105.4	119.3	132.0	119.8	118.0
Electrical equipment	100.0	98.4	97.4	96.8	96.8	99.0	101.8	103.0	104.8	108.3	111.0
Heating, ventilation equipment	94.5	93.2	92.9	92.0	91.7	92.5	92.6	94.9	97.6	102.4	107.0
Paints and other chemicals	103.6	103.8	103.8	104.7	105.4	106.8	109.3	114.6	119.2	122.9	127.5
Petroleum products	99.3	98.2	97.2	92.7	95.9	99.5	102.2	100.3	101.8	103.3	105.0
Fixed equipment	100.0	100.3	99.7	100.0	99.7	102.4	105.3	108.9	112.1	115.3	119.0
Appliance	95.2	94.0	91.8	91.3	89.2	89.1	90.1	92.2	93.0	95.3	97.0
Furniture	102.8	103.8	104.6	105.3	106.2	109.1	112.8	117.2	122.3	125.9	130.0
Machinery	102.3	102.3	102.2	102.9	103.7	108.2	111.8	115.2	119.0	123.5	128.0
All other materials	101.3	101.0	101.0	102.4	102.5	104.8	106.3	109.0	112.7	117.3	121.0

When we turn from materials to on-site labor, the increase is even more dramatic. The largest changes have come in supervisory costs and common laborer costs. Comparatively, the best bargains are brick-layers, followed by painters, since what is built of brick needs less painting maintenance, this represents an interesting trade-off situation. The complete table is shown on the next page.

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
ON-SITE LABOR COSTS	113.9	117.8	122.5	127.2	132.9	138.5	146.8	156.4	170.8	191.2	207.0
Professional, supervisory	113.6	117.9	12[illegible]3	128.2	134.1	141.2	149.9	161.5	176.4	198.1	216.0
Bricklayers, related workers	111.9	114.9	118.3	121.6	126.3	129.9	136.1	145.1	156.2	174.4	189.0
Carpenters, related workers	113.9	117.6	122.3	126.0	131.8	137.0	144.8	154.6	166.8	185.5	201.0
Electricians, related workers	113.7	119.4	123.8	127.9	131.4	136.1	143.2	152.2	167.2	186.3	203.0
Painters, related workers	112.2	115.9	121.0	125.3	130.5	136.0	143.6	152.7	164.0	181.4	195.0
Sheet metal, iron-workers, related workers	114.4	118.1	123.2	127.5	132.6	138.5	146.9	155.2	168.0	191.2	199.0
Plumbers and related workers	112.7	116.2	121.0	126.7	132.3	136.9	144.5	154.4	169.5	188.9	206.0
School construction common labor	116.5	121.0	126.7	133.3	140.7	148.9	160.1	170.3	190.5	214.8	236.0

Off-site labor costs are of varying importance depending upon local codes and contractor viewpoints. Thus the final component in the College Management's College Building Index may be of greater or lesser importance to one reader than another. The figures are:

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
OFF-SITE LABOR COSTS	112.4	116.9	120.1	125.5	130.9	137.1	144.2	152.7	164.4	175.2	187.0
Administrative, supervisory	113.3	117.7	122.0	126.3	130.7	137.3	145.3	154.7	168.3	180.0	193.0
Off-site manufacturing	112.6	117.0	121.1	125.9	131.5	138.5	146.7	156.7	170.4	183.3	197.0
Off-site distribution of materials	112.6	117.7	122.1	126.8	132.9	137.7	142.9	148.1	156.6	163.5	171.0
All other off-site construction costs	109.7	113.2	115.9	119.4	122.9	127.3	132.2	140.5	148.9	156.8	165.0

It is estimated that of every dollar expended on campus construction in 1971, 42.2¢ went for materials, 19.4¢ represented off-site labor costs and 38.4¢ represented on-site labor costs. According to College Management this represented a shift of one cent less being spent in 1971 for materials over 1970 and that same one cent being spent in 1971 for on-site labor. Off-site labor's proportion of the campus building dollar held even between 1970 and 1971.

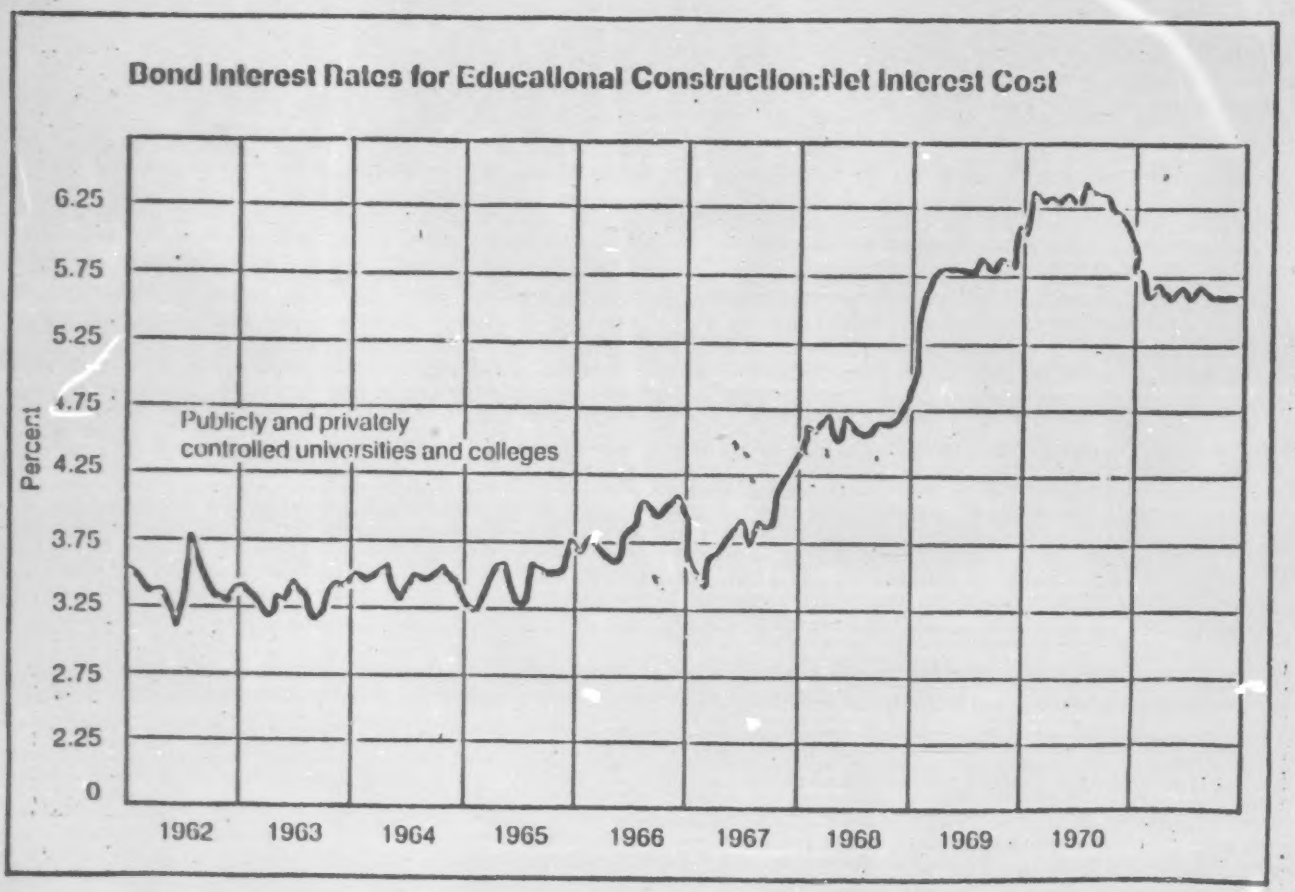
A good deal of emphasis in recent years has been focused on college and university building bond issues and their success or failure with the electorate. Data presented by College Managementdoes show trend characteristics worth mentioning. In terms of the percent approved based on number, the figures show:

1966	73%
1967	56
1968	79
1969	61
1970	48

The comparable percentages when dollar value is used as the basis for the percentage calculation are:

1966	44%
1967	36
1968	61
1969	36
1970	20

Set forth on the following page is a reproduction of a chart on bond interest rates for educational construction as presented in the June 1971 issue of College Management. It graphically depicts the changes in the net interest costs over the past several years, yet another indicator of the costs hidden in delayed decisions about construction.

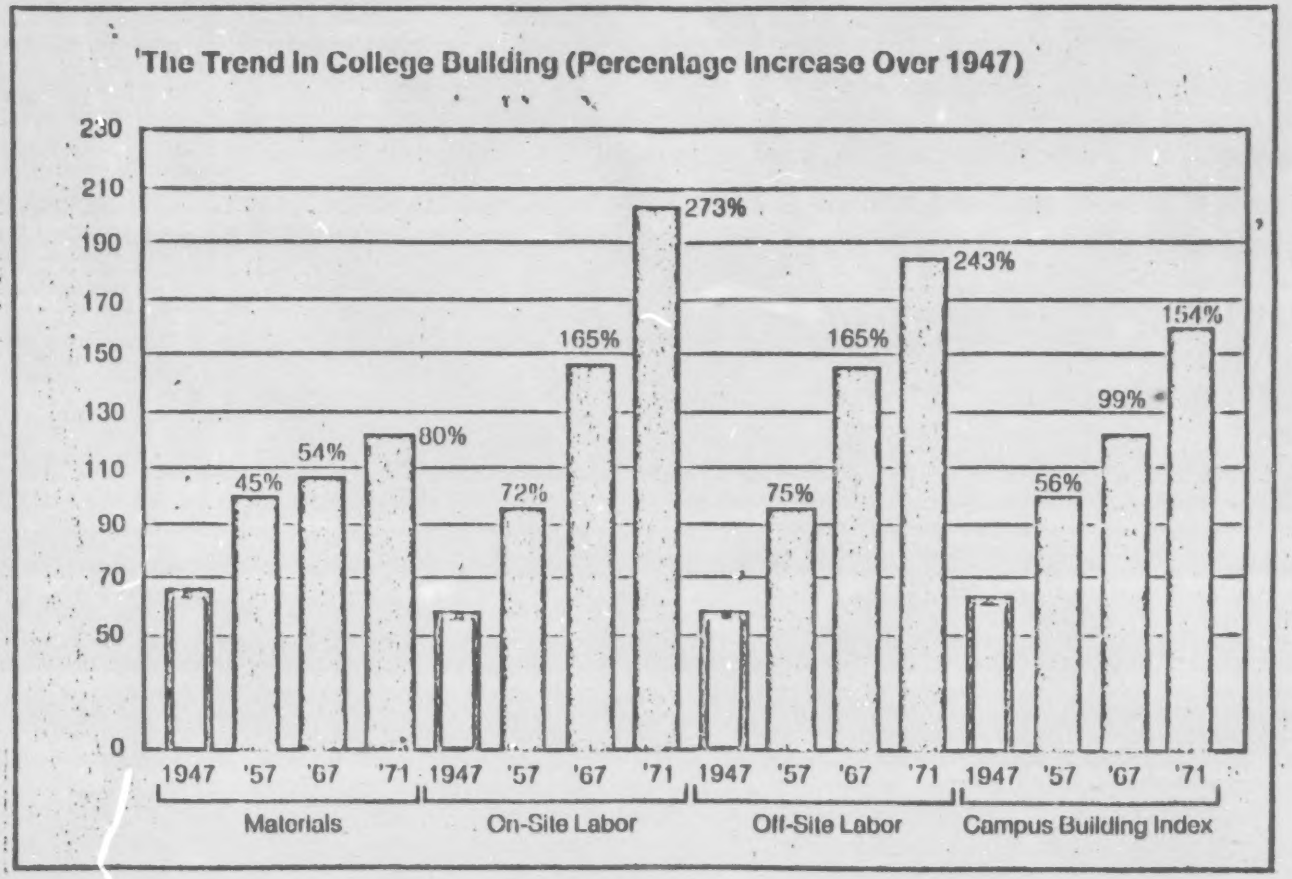


The yearly average would seem to run something like 1963-3.5%, 1964-3.5%, 1965-3.5%, then in 1966-4.0%, back down slightly in 1967 to 3.8%, then 1968-4.6%, 1969-5.8%, and 1970-6.8%.

Perhaps the most important comparison in terms of cost realities is to be found in the table on the following page which, like the foregoing tables is based on the report of College Management, although adapted for the purposes of this analysis. The table gives for 1970 and for 1971 the average cost per square foot of construction projects started by institutions of higher education in the U.S. The figures give the cost in dollars for 1970, for 1971 and the percentage change.

	1970	1971	% Change
INSTRUCTIONAL FUNCTIONS			
Educational laboratory	$35.05	$41.25	+17.6%
Fieldhouse gymnasium	22.52	28.00	24.3
Instructional-classroom	29.74	35.55	19.5
Instructional-laboratory	32.77	37.58	14.6
Library	32.21	36.20	12.3
Teaching hospital	45.71	56.12	22.7
RESEARCH FUNCTIONS			
Agriculture	29.96	32.76	9.3%
Astronomy	43.00	48.50	12.7
Biological	39.37	41.50	5.4
Chemistry	39.44	48.85	23.8
Math and statistics	25.72	40.55	57.6
Physics	42.27	48.77	15.3
Other physical science	40.63	44.20	8.7
Social sciences	34.11	37.83	10.9
Dentistry	51.88	58.01	11.8
Engineering	35.04	39.75	13.4
Medicine	39.29	52.10	32.6
GENERAL FUNCTIONS			
Administrative building	30.31	36.65	20.9%
Auditorium	28.70	33.37	16.2
College union	28.13	34.46	22.5
Extension service	29.24	N.A.	-
Faculty club	35.70	N.A.	-
Food facilities	31.69	36.70	15.8
Garage-vehicles	8.44	9.59	13.6
Office building	26.55	38.27	44.1
Theater	38.42	43.70	13.7
RESIDENTIAL FUNCTIONS			
Married student apartments	22.70	27.65	21.8%
Men's residence hall	23.90	28.25	18.2
Women's residence hall	23.63	25.10	6.2
Coed residence hall	27.62	30.55	10.6
Other residential	19.14	N.A.	-

The best summary of where cost realities have been is depicted graphically in the following chart published by College Management in their June 1971 issue.



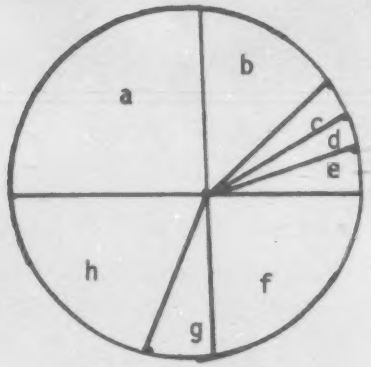
There used to be an old saying "that if you had to ask what it cost, you couldn't afford it in the first place." It should be abundantly evident that if such an attitude ever had any place in considering college construction, it has no place now. The key to successful building is certainly asking what it will cost and then guaranteeing that the cost quotation is closely adhered to by a project management system that will keep your construction on the track.

Another, complementary approach, to assessing likely costs of a building project is to review architectural literature for articles on structures similar to that which you are considering. College & University Business, Architectural Record, Progressive Architecture, and dozens of other leading magazines periodically publish articles, floor plans, pictures and statistics on college buildings. Many of these magazines are collected by your library or will be available from a friendly architect or by directing a specific query to the editors of the magazines themselves. These inputs will allow you to grossly assess the dimensions and results of similar building efforts. These must be considered only as gross, normative information. Geographical location, transportation, time, building process and building differences can form the basis for wide variation in building costs. Is site-work included in cost per square foot figures? Is moveable equipment included, etc.? are the kinds of questions to keep in mind when reviewing such literature. (See Figure 1) The search will provide not only a basis for comparison, as does the College Management material, but it will also provide a basis for comparison of "expectations," i.e. what I can hope to obtain for my dollars. A similar worthwhile effort is to request information from your colleagues at institutions where similar building projects have recently been completed. Recently, a trustee of a small private college approached a consulting firm with the question: "I've been told our new dormitories will cost an average of some $12,000 per bed. Is that the best I can expect or are there other ways to do the same job at less

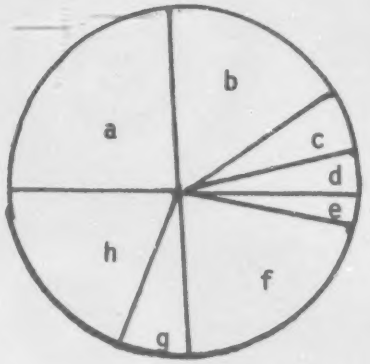
Figure 1

ALLOCATION OF CONSTRUCTION COST[5].

CONVENTIONAL		HIGH-RISE
1.7%	General	1.4%
1.7%	Excavating & Grading	0.85%
25.5%	Structural Frame	24%
12%	Masonry & Stone (WP&DP)	14%
1.25%	Roofing & Sheet Metal	1%
1.75%	Misc. & Ornamental Iron	3%
4.35%	Carpentry & Millwork	7.75%
1.75%	Metal Doors & Frames	0.82%
4%	Windows, Glass, Glazing	4.5%
6%	Tile, Marble & Terrazzo	4%
2%	Lathing & Plaster	5.5%
0.75%	Acoustic Tile	0.7%
1%	Composition Flooring	0.88%
2.25%	Painting & Caulking	1.9%
1%	Finish Hardware	1%
1.5%	Elevators & Dumbwaiters	5%
22%	Mech.Equip. & FoodEquip.	16%
8.5%	Electrical	7%
1%	Miscellaneous	0.7%



CONVENTIONAL



HIGH-RISE

a - STRUCTURAL FRAME

b - MASONRY & STONE

c - CARPENTRY & MILLWORK

d - WINDOWS, GLASS, GLAZING

e - TILE, MARBLE & TERRAZZO

f - MECH. EQUIP. & FOOD EQUIP.

g - ELECTRICAL

h - MISCELLANEOUS

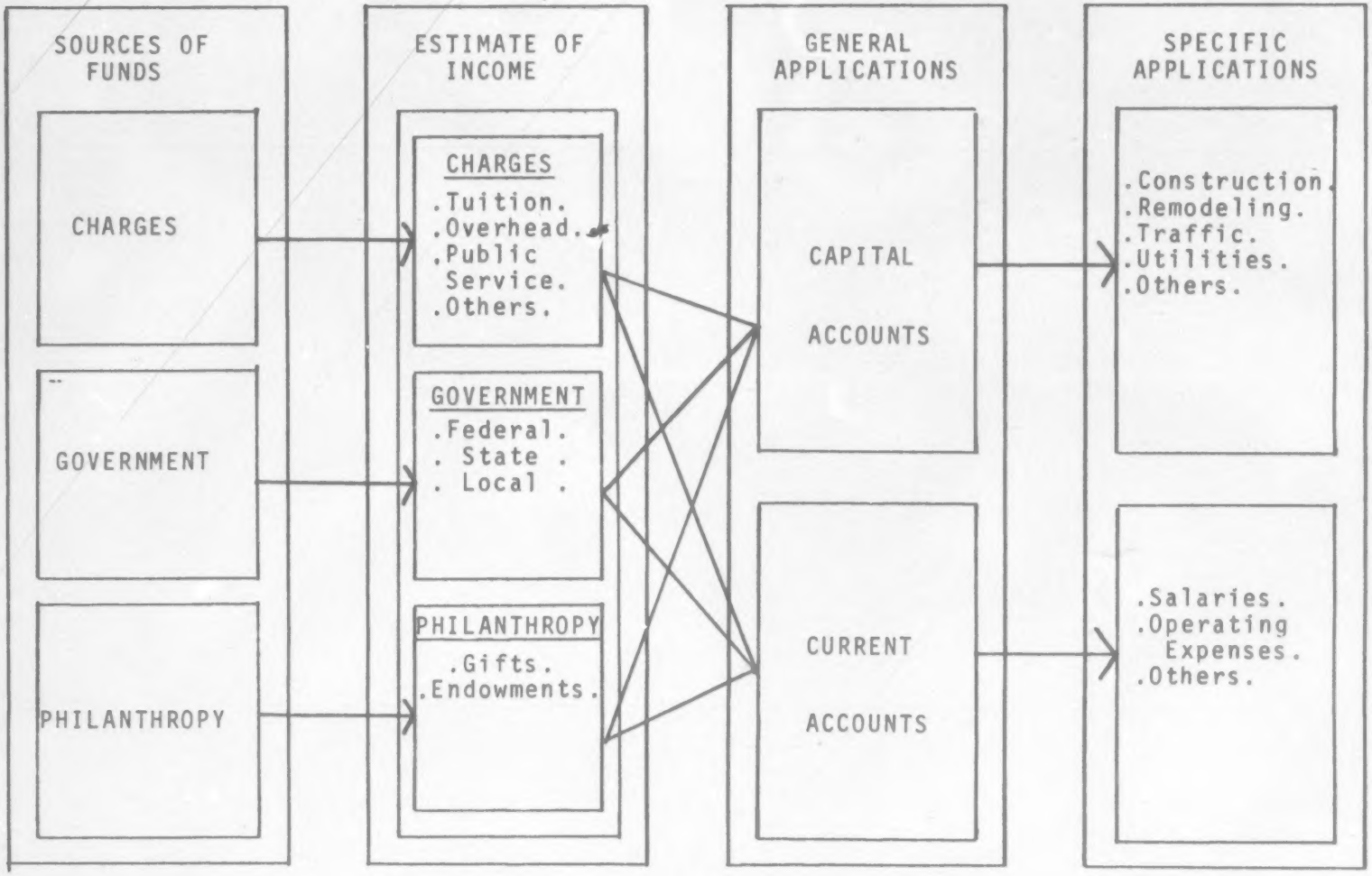
Figures indicate percent of total construction cost allocated to various contract categories for two buildings of comparable size and quality at the same institution.

cost?" From files available in the firm's office, it was possible to give the trustee the names of five college business officers whose institutions had completed construction of new dormitories in the past year for under $7,000 per bed.

The trustee was then able to arrange a visitation to each of the project locations and see the trade-offs necessary to bring in a dormitory at a cost some 40 per cent less than was originally quoted. Such gross analysis and anticipation techniques all have an important role in determining the fiscal realities of a building, initially. As detailed program plans begin to form, however, revealing the essential characteristics of your new building, it will be possible to utilize specific information from College Management or College Construction Reports of McGraw-Hill Information Services to grossly estimate the relative costs of alternative approaches to providing the essential characteristics of your building. This is the second level of analysis -- costing of alternatives -- which allows an institution to immediately drop from consideration some alternatives under discussion on the basis of cost or time to completion. This is a most creative step, one frequently omitted by institutions. This error of ommission eventually results in the chewing up of time in unnecessary discussions of obviously unfeasible solutions. And time is the critical factor in bringing buildings in at budgeted prices.

At this point a third level of analysis becomes necessary. Now that we have a fairly clear picture of what our building is and

Figure 2 Basic Elements of Income Model



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some estimation of what it is likely to cost, a review of likely sources of finance becomes necessary. What federal programs are available? What are the positive and negative aspects, including the extent of federal participation? Can a capital giving campaign provide the necessary dollars? Or should we look at private capital as our primary source? Obviously, a combination of all sources becomes another possibility. What are the cost ramifications of each single or all possible combinations of financing? How realistic are they? (See Figure 2)

An inextricable portion of this analysis is a realistic appraisal of institutional fiscal stability. If we do obtain the necessary funds to build it, can we pay increased operating and maintenance costs, can we equip it, can we staff the programs anticipated for it? One institution was given a million dollars for a special purpose building. Analysis showed that costs would approximate an additional $2.5 million over the next four years. The gift was accepted ("It was $1 million more than we had . .") and the building was built. Today, 50 per cent of the building is unequipped and therefore unusable, the remainder of the space remains unattractive and is falling rapidly into disrepair. Obviously, the college could not absorb the incremental costs necessary.

Stated simply, the objective of this stage of the financial planning process necessarily involved in a new construction program is to provide answers to three basic questions:

1. How much will the proposed programs cost?
2. How much income will be available from which to finance the programs?
3. If projected costs exceed projected income, what can be done to obtain a balance between them?

The financial analyses necessary for effective project planning are conveniently provided in an analytical framework suggested by Dr. John D. Millett, Chancellor, Ohio Board of Regents in an article appearing in College and University Business, February 1968. (See Figure 3)

The incremental costs of the new programs then constitute a fourth, and more detailed, level of analysis.

The fifth, and final, level of analysis which is necessary is to combine inputs from the above stages together with new information and arrive at anticipated costs to the capital account, this would include:

1. Costs of construction -- building
2. Costs of construction -- utility systems
3. Costs of construction -- traffic systems
4. Alterations to existing buildings, if any
5. Provision of major equipment

Experience has proven that at this fifth stage, hiring of a professional cost estimator is highly desirable and effective (this professional would then be kept on the project until completion, since building modifications -- which can sometimes contribute an additional 35 per cent over run on a project --

Figure 3 Analytical Framework For Financing Higher Education

ACTIVITIES	SOURCES OF INCOME	APPLICATION OF FUNDS	TYPES OF INSTITUTIONS	SPONSORSHIP OF INSTITUTIONS
1. Instruction	1. Charges	1. Current Account	1. Universities	1. Private a) Nonsectarian b) Church-Related
2. Research	2. Government a) Federal b) State c) Local	2. Capital Account	2. Colleges	2. Public a) Federal b) State c) Local
3. Public Service	3. Philanthropy a) Endowment b) Gifts		3. Professional Schools	
4. Auxiliary Service			4. Community Colleges	
5. Student Aid				

will occur). In processes previously described, however, you have already arrived at a series of cost estimations.

As soon as a reasonable cost package has been put together for your building project one of the first things to do is to immediately add to the project budget a minimum of 5 per cent for design contingencies and 5 per cent for construction contingencies. Looking at your project's time table, you must also throw in a minimum inflation factor of 1.5 per cent per month on the uncompleted sections of the building (as represented by a dollar value), much in the same way finance charges are calculated by credit card companies. It may seem strange to enlarge project budgets in this way from the onset as a portion of cost-estimation, yet design changes, construction changes, and inflation are the deadliest enemies of project budget control. By estimating these costs in advance you will have prepared a realistic budget and later, as the project advances, changes and delays, which will undoubtedly occur to one extent or another, can be costed at the time and listed on a sheet of paper. When changes or delays cause costs to approach the budgeted maximum as shown on your cumulative record, the problem should be faced up to. Modifications (trade-offs) can be effected to bring project and budget into line. "Too frequently this is not done, or it is hoped that the original estimates were high or the bids may be lower than normal. It seldom occurs that way."

After these analyses are complete, you will have a clear picture of the constraints within which you must operate for a particular building. This information is then translated first to the architect and later, upon modification, to potential contractors in the bidding process (both of these steps are treated at length elsewhere in this document).

It can safely be said, however, that only when funds are committed can a decision be considered finalized. After trustee concurrence with the building project, adjustments must be made in the budgets which have either been decided upon or are about to be decided upon, depending upon when the building project cycle begins and is estimated to conclude. It is at this point that normal line-item, one-year approaches to budgeting become a hindrance rather than a help and when a multi-year program budgeting format becomes desirable. Since building projects occur generally over a time span likely to lap budget periods, processes and fiscal years, individual implementation components and their cash consequences must be phased in according to a pre-determined schedule, over this time-frame. It is not the purpose of this manual to discuss at length program budgeting systems. It is within the purview of this document, however, to counsel preparation of relevant budget documents complementary to the building project which provide for articulation of costs over a minimum five-year period.

To this point in your building project you have accomplished a great many things; however, the building itself seems too

illusive. So far our activities have produced only organizational patterns, a great deal of data collection and thinking (individually and collectively), and a pile of paper. It is only human at this point to be slightly frustrated, harboring an almost irresistable urge to see a spade bite into the earth or a construction sign go up or a contractor's truck drive past. The urge must be repressed: a great deal of "front end" work still remains to be done before your new building is completed on campus efficiently and effectively.

One major step still remains to be done in the financial realm: Production of a pro-forma document for presentation to funding sources. Frequently, this step is done in an off-handed manner. Because we know exactly what we want and why, we fail to realize that we must communicate that rationale convincingly to the money sources. Being sloppy in this critical step complicates an already complicated process and cuts the likelihood of funding from some otherwise promising quarters.

A pro-forma statement is compiled for three purposes. First, it provides an outline of the proposed building which the college wishes to build. Second, it presents business information on which potential mortgages can base a lending decision. Third, it demonstrates how:

1. Such a mortgage loan is a financially attractive, secure and socially rewarding venture for the investor.

2. Funds invested in the college are entrusted to a uniquely competent custodian of those funds who operates in a relatively riskless environment.

3. The strategy of building the building is the most certain and promising strategy for the college to pursue.

A professionally produced pro-forma statement will include the following major sections, appendicies and graphics:

SECTION 1: Purpose and Scope

A brief rationale for what is being proposed.

SECTION 2: Proposal Abstract

A concise statement of what is being proposed.

SECTION 3: Sources of Funds

A concise statement of where funding will come from, drawn from your income analyses, backed up with illustrative charts.

SECTION 4: Uses of Funds

Specific purposes to which funds will be put; description of what will go into the building; positive impact this building will have on the college.

SECTION 5: Risk-Return Analysis

Brief rationale of reasons why a funding source should be attracted to the proposal, in general. (Example: "The remainder of this section is designed to identify the tangible and intangible returns available to participating lenders and to analyze those risks to which lenders would be exposed . . .Two types of quantifiable returns are available to lenders: 1) an attractive return on committed capital, and 2) solidity of the financial affairs of the college make it an attractive commercial account." And so forth.)

SECTION 6: Recent History

A description of the growth pattern of the college, its basic successes, its basic reason for being. Include summary chart on enrollment, relation to "local/regional" educational market, and income cashflow.

Note: The following section outlines the reasons why the college administration and its advisors believe that the decision to build a new building will increase the prospects for the college's continued success in achieving its goals.

SECTION 7: Why A New Campus?

A. Goals and Objectives

B. Strengths of the College
1. Administration
2. Faculty
3. Non-Profit Status
4. Accreditation
5. Reputation
6. Student Body
7. The Curriculum
8. Other programs
9. Placement
10. Alumni

C. Weaknesses (list all appropriate)

D. Conclusion: (Example: "After comparing the college's strengths and resources with its critical problem areas, the administration translated its general objectives into the following set of planning objectives.")

SECTION 8: A. Describe briefly the objectives for which building is designed.

Note: Before continuing with detailed programs and building plan descriptions, the following appendicies should be inserted in the pro-forma document:

1. Financial Projections

A. Auditor's statements

B. Sources and uses of funds detail

2. Financial History

A. Income and cash flow, summary

B. Income statements and balance sheets, summary

C. Certified statements for year just ended

D. Certified statements for year ended previous

3. Appraisal of College Properties

   A. Statement of Fair Market Value

4. Degrees held by faculty members

5. Description of Government Monies Used in Past

6. Admissions and Enrollment

   A. Admissions history

   B. Enrollment history and projections

   C. Enrollment history by sex

   D. Enrollment by high school, by locale

Note: Your pro-forma document is now ready to present your building plan in detail. This portion will all be pertinent information relative to your proposal. Sections must include:

SECTION 9: Purpose and Scope

SECTION 10: Timetable

SECTION 11: Program

SECTION 12: Site Analysis

SECTION 13: Master Planning

SECTION 14: Building Systems

SECTION 15: Cost Analysis

SECTION 16: Recommendations

Note: Summary graphics should be considered for each of the above sections. In addition, the following appendicies would be beneficial to this section:

1. Timetable for Architectural and Engineering phase

2. Summary of Existing Facilities

3. Survey Conclusions

4. Preliminary Cost Estimates

With these materials edited, illustrated and printed in logical and attractive fashion, you are now ready to go to any funding source with authority. One caution is that total familiarity with the document will be mandatory for whoever is responsible (development officer?) for reviewing and presenting the material. With a convincing document and an unknowledgeable presenter, results could be negative. Both must complement one another.

SOURCES OF FEDERAL FUNDS

HIGHER EDUCATION FACILITIES ACT OF 1963 (P.L. 88-204)

"An Act to authorize assistance to public and other non-profit institutions of higher education in financing the construction, rehabilitation, or improvement of needed academic and related facilities in undergraduate and graduate institutions."

FINDINGS AND DECLARATION OF POLICY

"Sec. 2. The Congress hereby finds that the security and welfare of the United States require that this and future generations of American youth be assured ample opportunity for the fullest development of their intellectual capacities, and that this opportunity will be jeopardized unless the Nation's colleges and universities are encouraged and assisted in their efforts to accommodate rapidly the growing number of youths who aspire to a higher education. The Congress further finds and declares that these needs are so great and these steps so urgent that it is incumbent upon the Nation to take positive and immediate action to meet these needs through assistance to institutions of higher education, including graduate and undergraduate institutions, junior and community colleges, and technical institutes, in providing certain academic facilities."

Title I. - Grants for Construction of Undergraduate Academic Facilities

The mechanics of this particular type of federal assistance initially takes place at the state level. In New Hampshire, the Higher Education Facilities Commission is the administering agency and pursuant to Section 105 of Public Law 88-204, and it administers the funds available to the institutions within the state according to the State Plan. The State Commission accepts applications for assistance in the construction of classrooms, laboratories, libraries and related administrative facilities. Gymnasiums used for physical education instruction and not for

events for which admission is charged are also eligible. Public community colleges and public technical institutes apply under Section 103 of the Act, while all other institutions of higher education apply under Section 104. Application forms can be obtained from the State Facilities Commission office in Manchester, New Hampshire.

For any specific project, up to $400,000- in assistance may be obtained provided that that $400,000- does not exceed one third of the total project development budget. There are two closing dates scheduled by the Commission, September 30 and February 15. Applications submitted before these dates will be considered with any other application from other schools on the closing date. The applications are graded by the Commission and the funds awarded to the applicant institutions on the basis of the grades obtained by the application. The Commission follows the grading procedures carefully enumerated in the State Plan and awards funds until the state's allotment is exhausted. Normally, the requests for assistance total more than the state allotment, so applicants should apply in time for the September 30 deadline -- careful attention must be given to the data requests in both the application and the State Plan. The State Commission will assist you in the development of your application and should be contacted well before the date of submission.

Title II. - Grants for Construction of Graduate Facilities

"Sec. 202. (a) Grants under this title may be made to institutions of higher education and to cooperative graduate center boards to assist them to meet the development costs for

projects for construction of academic facilities for graduate schools and cooperative graduate centers.

Title III. - Loans for Construction of Academic Facilities - Interest Subsidization

(Annual Interest Grant Program)

"Sec. 301. The Commissioner may, in accordance with the provisions of this title, make loans to institutions of higher education or to higher education building agencies for construction of academic facilities."

"Sec. 303. (a) No loan pursuant to this title shall be made unless the Commissioner finds (1) that not less than one-fourth of the development cost of the facility will be financed from non-Federal sources, (2) that the applicant is unable to secure the amount of such loan from other sources upon terms and conditions equally as favorable as the terms and conditions applicable to loans under this title, (3) that the construction will be undertaken in an economical manner and that it will not be of elaborate or extravagant design or materials, and (4) that, in the case of a project to construct an infirmary or other facility designed to provide primarily for outpatient care of students and institutional personnel, no financial assistance will be provided such project under title IV of the Housing Act of 1950."

"Sec. 303. (b) A loan pursuant to this title shall be secured in such manner and shall be repaid within such period not exceeding fifty years, as may be determined by the Commissioner; and shall bear interest (1) a rate determined by the Commissioner which shall be not less than a per annum rate that is one-quarter of 1 percentage point above the average annual interest rate on all interest-bearing obligations of the United States forming a part of the public debt as computed at the end of the preceding fiscal year, adjusted to the nearest one-eighth of 1 per centum, or (2) the rate of 3 per centum per annum, whichever is the lesser."

Annual Interest Grants

"Sec. 306. (a) To assist institutions of higher education and higher education building agencies to reduce the costs of borrowing from other sources for the construction of academic facilities, the Commissioner may make annual interest grants to such institutions and agencies."

"Sec. 306. (b) Annual interest grants to an institution of higher education or higher education building agency with respect to any academic facility shall be made over a fixed

period not exceeding forty years, and provision for such grants shall be embodied in a contract guaranteeing their payment over such period. Each such grant shall be in an amount not greater than the difference between (1) the average annual debt service which would be required to be paid, during the life of the loan, on the amount borrowed from other sources for the construction of such facilities, and (2) the average annual debt service which the institution would have been required to pay, during the life of the loan, with respect to such amounts if the applicable interest rate were the maximum rate specified in section 303(b): Provided, That the amount on which such grant is based shall be approved by the Secretary."

"Sec. 306. (e) No annual interest grant pursuant to this section shall be made unless the Commissioner finds (1) that not less than 10 per centum of the development cost of the facility will be financed from non-Federal sources, (2) that the applicant is unable to secure a loan in the amount of the loan with respect to which the annual interest grant is to be made, from other sources upon terms and conditions equally as favorable as the terms and conditions applicable to loans under this title, and (3) that the construction will be undertaken in an economical manner and that it will not be of elaborate or extravagant design or materials. For purposes of this section, a loan with respect to which an interest grant is made under this section shall not be considered financing from a non-Federal source. For purposes of the other provisions of this Act, such a loan shall be considered financing from a non-Federal source."

Applications for assistance under both Title I and Title III require a considerable amount of preconstruction planning and must be timed to properly fit within your general development plan.

The physical description of your project contained in your application is used along with your general institutional statistics for competitive grading of all the applications by the State Commission. The fact that the project description (including gross and net square feet) is used for grading means that you are held to the minimum facility described in the application, and if after the fact you wish to increase the facility's size,

you will not be eligible for additional assistance -- so carefully think out your application. For example, under the State Plan for Title I, the amount and percentage of expansion your new project contributes to your total physical plant is computed and weighed against the other applicant's competing for assistance. If you must decrease the project by more than 5 per cent due to design changes or lack of adequate financing, you will probably have to withdraw your application and resubmit one for the next closing, causing you to lose a minimum of six months and probably one year. Also, there is no guarantee that your application will again be successful as the competition will also change over that time period.

Under Title III your application must not only contain accurate physical descriptions of the project, the proposed financing must also be described. The language of the enabling legislation may be a bit confusing but, in essence, the procedure is as follows: The Office of Education is prepared to help you finance the construction of academic facilities. In addition to direct grants for a portion of the proposed facility (Title I, Secs. 103 & 104), it is prepared to loan you funds (Title III) or help you repay loans you have negotiated with private lending institutions (Interest Subsidization - Annual Interest Grant Program). The Office of Education is obviously interested in helping as many institutions as it can with its allotment of Federal assistance, therefore, the Annual Interest Grant Program will probably completely replace the Title III

loan program. In fiscal year 1970, eighty-six Annual Interest Grants were approved supporting over $119 million in loans, and in fiscal year 1971, approximately $18 million in grants will support over $520 million in loans.

The Annual Interest Grant Program can be used to pay the interest charges on a loan that falls between 3% per year and the rate that the government itself pays for interest-bearing obligations that form the national debt. For example, if you arrange a thirty year loan for a classroom building at an annual rate of 8.5% per year, the Annual Interest Grant Program would pay the interest charges on the loan between 3% and 8.5%. Thus the institution has only to pay the principle and 3% per year for thirty years. The difference between this arrangement and the Title III loan is that the government does not have the large sums necessary for the principle so the institution nets the same fiscal assistance (a 3% loan) but the government's exposure is spread over the life of the project and not at the beginning of all the projects.

From the institution's point of view, the optimum fiscal arrangement uses both Title I and Title III (Annual Interest Grant Program) and might be as follows: A hypothetical classroom building project costing $1,300,000- could be funded in the following manner - a $400,000- Title I grant (maximum allowable under the State Plan), a loan of $770,000- subsidized through the Annual Interest Grant Program and $130,000- from the institution's resources or a non-subsidized loan. The program

constraints of the Annual Interest Grant limit the Federal participation to 90% of the development costs, therefore, only a loan of $770,000 can be subsidized. However, this package presents a fairly attractive financing program as the institution can build its project with minimal cash outlays and an extremely advantageous debt service schedule.

This type of Federal assistance works very well, however, the institution's applications cannot be exploratory in nature. The project must be well thought out and alternative financing plans as well as construction plans must be available. For example, in the hypothetical classroom project, provision must be made for an alternate source of funds in the event that the application for Title I was not successful or only partially successful. Contingency financing should probably be made when the large loan is negotiated. Or, if the timing of the application is sufficient, the project may be collapsed to the point that the interest subsidy and the institutional resources cover the cost of a smaller classroom building. This type of adjustment calls for tight design and an expandable/collapsible building. Or the project may be built as planned with an increased subsidized loan and a supplemental Title I application could provide the funds for the following fiscal year and the increased non-subsidized loan could then be prepayed. There are a number of options which should be forecasted and planned for. The Facilities Commission staff in Manchester, N.H. and the Office of Education staff in Boston, Mass. are available

to you and will provide you with assistance in both the planning and submission of applications that will best suit your needs.

The other most frequently available source of construction financing is the Department of Housing and Urban Development's College Housing Program. There are no direct grants available under this program, however, direct loans and interest subsidization grants are available for the construction of student and faculty housing, dining facilities, student unions and infirmaries.

New Hampshire is fortunate to have a Department of Housing and Urban Development Area Office located in Manchester. The College Housing Program for this region is administered by this area office. Applications are submitted in the spring and awards are usually made by June 30.

The College Housing Program is authorized under the Housing and Urban Development Act of 1968 (Section 1705) which amends Title IV of the Housing Act of 1950. The Direct Loan program is very similar to Title III of the Higher Education Facilities Act while Debt Service Grant Program is the College Housing Program's version of the Office of Education's Annual Interest Grant Program.

Applications for College Housing Program assistance are in every sense preliminary proposals to H.U.D. and must show the economic feasibility of the project as well as the preliminary design of

the project. The amount of money available to an institution is based on a relatively simple formula: $1,500.00 per full-time student adjusted by the regional construction cost estimate is the maximum borrowing potential of the institution. For example, if your school reported 1000 full-time students enrolled in September of the year in which you apply for assistance, you would be eligible to borrow $1,500,000-. However, this must be adjusted by the regional construction cost index (for Manchester, N.H. the index is set at .88) so the $1,500,000- is reduced to $1,320,000-.

$$\frac{(\$1{,}500)(1000 \text{ full-time students})}{(\text{construction cost index } -.88)} = \text{institution borrowing power } \$1{,}320{,}000-$$

Institutions are not limited to one application per year, however, so more than one project may be proposed during an academic or fiscal year. The application (HUD Form 4501) requests the normal institutional statistics and an architectural description of the project. In addition, a preliminary project cost analysis must be provided showing a project development line item budget, unit cost breakdown, and a project development time schedule. A narrative must also accompany the application detailing the effects of the proposed project, the insufficencies it will correct or the potential for growth it will provide.

You will normally apply for a Debt Service Grant (the reasoning here being the same as the rationale for the Annual Interest

Grant Program, the more schools served with the least amount of governmental dollars encumbered) and in cases where private capital is not available or not available at a reasonable rate, the institution may be awarded a direct loan. The instructions accompanying the application and the availability of the College Housing Representative attached to the Area Office make the application process a relatively simple task. A word of caution here -- the project should be designed so that it is self-supporting and so that the debt service as well as the operation of the proposed facility can be covered by the revenues the facility will generate. The principle and 3 per cent per year must be paid back under both programs.

Although the application is a preliminary proposal, the project must be well thought out, some sort of architectural description must be given, short-term and long-term financing plans must be described, and evidence of need must be presented.

The housing study described in a preceding chapter of this manual should provide you with all the relevant statistics necessary for this project. The pro forma statements described in the preceding chapter should also provide the necessary financial information for this preliminary application especially when they are combined with the housing study data. If the application is successful, a great deal of detailed financial information will be requested by H.U.D. and those pro forma statements can become part of the supplemental financial application.

If the preliminary application is successful, H.U.D. will inform you that a "fund reservation" has been made and will then request detailed legal, financial and engineering information. The legal and financial information will concern both the project and the institution. The engineering data must show that the project is architecturally feasible and that the cost will fall within the H.U.D. allowable unit costs. If the supplemental exhibits (legal, financial and engineering) receive H.U.D. approval, a preliminary loan agreement will be drawn up and you will be allowed to produce bid documents for H.U.D. review and for release to potential bidding contractors. In this arrangement, the government is very much involved in the detailed pre-construction and financial planning.

Recently, H.U.D. has encouraged institutions to construct their housing and dining (student union) facilities using the "turnkey" development procedures that have been successful from a time and cost basis in their Public Housing projects. The "turnkey" method of construction differs considerably from the traditional construction methodology. Traditionally, an owner (institution) retains an architect to design a project, working within a set of objectives and finances. When the design is complete, contractors are then encouraged to bid on the job and hopefully, if the architect has done his job, a bid will be forthcoming for the project that falls within the available financing. In this scheme, the owner and the architect work closely to design a project which can be built with the available

dollars but it is not until the owner has paid eighty (80) per cent of the architect's fee and the bids are opened does he know if he has a building project. If the bids are too high, the project must either be redesigned or cancelled. The design phase of the project stretches over many months before the owner is certain that construction will actually take place.

The "turnkey" approach is unique in the fact that the owner (institution) does not retain an architect to custom design the proposed facility. The owner requests proposals from firms who will both design and construct the project thus no design is created that cannot be built within the available budget. Mechanically, the owner with the help of an architectural consultant, articulates the constraints to be placed upon the project and then requests proposals from qualified firms for the design and construction of the project.

The constraints usually contain a description of the site that is available, the number of beds or capacity of the project, the amount of money that is available for the project, the architectural performance standards (durability of the structure, quality of fixtures and appliances, ease of service and maintenance, minimum requirements for room sizes and capacities), social program (description of the people using the building, e.g., married students with and without children, single graduate students, etc.) and the development time schedule.

The architect/consultant and the institution review the proposal and select the proposal that best suits the needs of the institution. The selection process is an analysis of the proposals from both the engineering point of view as well as the financial point of view and the winning proposal may not be the proposal with the smallest price tag. The institution now gets the opportunity to review the work of many architects (each firm responding to the request for proposals must have an architect registered in the institution's state) and choose the design and delivery system that offers the best value for the available dollars. H.U.D. will also assist in this evaluation/review process.

The financial exposure to the institution before actual construction is obviously reduced using the "turnkey" approach -- the institution does not commit itself to 80% of the architect's fee to determine the feasibility of the project, the time span covering the design phase of the project is considerably shortened thus offsetting some of the built-in inflationary costs and the firm who will do the actual construction work will be familiar with the project reducing the possibility of design oversights which result in costly change orders during the course of construction.

There are some other related benefits of "turnkey" construction such as this method's adaptability to "fast-tracking." "Fast-tracking" is the engineering jargon of designing a project in a series of building systems rather than the completed structure

so that while the foundation is being poured, for example, the interior wall panels may still be in the design phase. The method is also called phased construction and is being experimented with in the Academic Building Systems (ABS) projects in Indiana and California. The involvement of "turnkey" contractors also makes the use of modular or panelized construction a more distinct possibility. This type of construction is usually less expensive per square foot than the traditional construction methods using on-site fabrication. The proposing contractors can figure this kind of construction from the onset rather than attempting to fit commercially available panels or units into a custom designed package.

Institutions of higher education can successfully use the "turnkey" approach to speed up and reduce the cost of construction, however, the method is not without its pitfalls. Before embarking on a "turnkey" project, be sure to obtain the services of an experienced architect/consultant, and to notify H.U.D. on your application as a slightly different set of H.U.D. reviews will be necessary for the project.

A note on the design of HUD-College Housing Program dormitories-due to the changing life styles of today's college students, H.U.D. strongly suggests that suite-type accommodations or apartments be constructed rather than tradition double-loaded corridor, gang bath facilities dormitories. This suggestion is based on the increasing difficulty in filling traditional dormitory units thus making these types of facilities an unsound

financial risk. Apartments and suite-type accommodations aside from student preference patterns are, in many cases, a better investment for institutions. Changing male-female student body ratios can be more easily accommodated in the suite or apartment style living quarters as fewer numbers of students are contained in each module. Traditional dormitories do not readily lend themselves to shifting student patterns whereas two contiguous suites or apartments may contain male or female students without breaching the rules of propriety. Apartments can serve both the married and the single student as well as the faculty, and in the event of a serious decline in enrollment, be let to tenants outside the institution.

Incidentally, the maintenance costs over the life of the building is lower for apartments and suite-type living units than traditional dormitories. When students are grouped into small suite-type living units, vandalism and willful distruction decreases and repair charges can be more equitably assigned to the tenants in the individual suites. In a dormitory, damage to the public areas and maintenance of those areas can become a large burden to the institution over the life of the building. Apartments offer the same type of student responsibility and are probably the most maintenance free, and whatever damage occurs has to be the responsibility of the individual tenant.

APPLICATION PROCEDURES

A sequential outline for processing a HUD College Housing Subsidy Grant from submission of the application to the execution of the final grant agreement follows.[9] Individual projects may vary from this schedule according to special circumstances:

A. Institution submits application (Form HUD 4501) for assistance to HUD Regional Office to establish:

   1) Legal eligibility of the applicant and project (Form HUD 4501-3).

   2) Need for the project.

B. HUD Regional Housing Assistance Offices processes application and:

   1) Verifies eligibility and need.

   2) Processes a fund reservation (Form HUD-718) if funds are available. (A fund reservation is not a legal commitment by HUD, but an action to reserve funds for commitment when the grant is approved.)

C. Applicant develops its plans for obtaining project financing with, or without, the assistance of a financial advisor. Normally, the applicant and the architect/engineer will proceed with the construction plans and specifications at this time.

D. Applicant submits to HUD Regional Office:

   1) HUD Concurrence. The applicant must consult with the HUD Regional Office prior to soliciting financing proposals from private lending institutions. The applicant must indicate the manner in which it proposes to seek the lowest net interest cost reasonably available, including the planned method of financing, the names and addresses of potential lending institutions, and the information to be furnished to such institutions. HUD will review the applicant's plans for obtaining project financing and will offer advice when necessary.

   2) Justification for any deviations from HUD policies and procedures specified herein.

3) Proposed contract for financial advisor, if such an advisor is employed.

4) Tentative project schedule (i.e., dates for bidding on construction contract and for obtaining loan funds).

5) Proposed interim construction or short term financing plan, if required.

E. HUD Regional Office reviews the applicant's plans for obtaining project financing; verifies the financial and legal ability of the applicant to borrow for the project; and consults with the applicant to insure that all of the objectives stated herein will be met. Normally, this will involve a meeting in the HUD Regional Office.

F. HUD Regional Office concurs in applicant's plans for obtaining project financing (see Note under Step K below).

G. Applicant (or Financial Advisor) invites bids or loan proposals from all potential lenders in accordance with the HUD approved plan for obtaining project financing.

H. Applicant (or Financial Advisor) reviews all loan proposals; computes and makes a tabulation of effective net interest costs of all loan proposals; makes recommendations on acceptance or rejection of proposal containing lowest net interest cost; and submits certified copy of tabulation and recommendations. The applicant must also submit to HUD, an outline of the steps taken to obtain the lowest net interest cost.

I. HUD reviews applicant's recommendations and supporting information and requests changes or provided the net interest cost does not exceed the rate on which the fund reservation was based authorizes applicant to close the private loan after execution of Grant Agreement. In the event that the interest rate used in establishing the fund reservation is exceeded, the Regional Office shall submit all proposals for project financing, together with recommendations, to the Central Office concurrence, the Regional Office shall authorize the applicant to close the private loan after execution of the Grant Agreement.

J. HUD prepares Project Summary and Approval, Form HUD-4528, (approved project cost budget).

K. Grant Agreement prepared and executed. HUD prepares; HUD and grantee execute. (Note: Steps J and K may follow Step F, if necessary to obtain loan proposals.)

L. Applicant advertises for construction bids on HUD approved plans and specifications.

M. HUD reviews construction bids and concurs in the award to the lowest bidder.

N. Applicant closes private loan and advises HUD.

O. Applicant awards construction contract to low bidder.

P. HUD recomputes grant amount based on actual lowest effective net interest cost and any revisions to approved project cost estimate, and adjusts grant amount, if necessary.

Q. Project costs are audited by HUD at conclusion of construction or a certificate in lieu of audit (Form HUD-4526) is submitted by the applicant to establish final eligible project cost. As soon as HUD determines the final eligible project cost, HUD prepares revised project summary, if necessary, and an amendatory grant agreement if there is a change in the grant amount.

The programs described in detail above are the major source of federal funds for college construction. There are, however, some 200 potential sources of funds in the federal establishment for construction programs or programs related to construction. In addition, some foundations have made substantial funds available to colleges for construction in the past, although the amounts distributed for this purpose in recent years has declined. Your Development Office will have, or can have with a bit of research, program citations which should be explored when reviewing possible federal or private sources of construction monies. For all practical purposes, however, the programs described above contribute by far the most dollars to college construction and should be checked out first.

THE COLLEGE AND THE ARCHITECT[7].

Just as an institution turns to a lawyer to assist it in its contractural work, so a college must turn to an architect for direction and assistance in planning and executing a building project. He is the one professional whose training and gifts combine the practical and the artistic. At best, architecture is a difficult art. It deals with materials, money, time and diverse personalities. Out of this, if successful, a practical yet artistic structure will hopefully emerge. The better it functions and the more it enhances the life of the college, the more successful is the architect and his work.

The college should have a definite set of goals that the architect can identify and express in tangible form (see chapter on Planning). A building program and ultimately the building itself should grow out of a philosophy or a set of goals. If there are no goals or building program, then the fundamental image and goals of the specific project must be defined by the college administration as they work with their architect. If not, the architect will have to assume what is lacking.

What does the architect look for once he is retained by the college? The architect seeks to understand the guiding philosophy of the college. He will probe for more specific information about the project. He expects that the college will have prepared for the project by compiling a building program, stating its needs in some detail. He also expects the college to have

some initial budget guidelines. To the extent that these exist, the architect accepts and reacts to them. If they do not exist or are only in partial form, he must work with the college to supply them.

The college that foresees years of active change and growth can prepare itself by assigning the task of long-range, physical planning to a Director of Development. The existence of such a person serves to focus attention on this important planning function.

As he assists the college in the formulation of a program, the Director of Development also can assist the architect and other consultants by acting as the college's representative for their detailed questions on a day-to-day basis. In the absence of such a person, someone must be assigned the task of working with the architect in developing the detailed program.

Before the architect is selected, the college must first decide, How is he to be selected and Who is to do the selecting? Generally, an Architectural Selection Committee is appointed. It should be small and appropriate, broadly representative of administration, faculty, alumni, and students.

With the selection of the architect the work of the Architectural Selection Committee is done, although this committee may carry on and become the Building Committee. This committee is responsible for representing the college and working with the architect until completion of the project. There should be

continuity between these committees by retaining much of the same membership, for obvious reasons. Ideally, the Building Committee should be composed of men of broad general background. Committees that include technical persons such as contractors or engineers often flounder through professional conflicts and conflicting professional points of view. The selection of the chairman of a Building Committee is most important. He must be a skillful negotiator, a broadly oriented generalist, rather than a technician -- in short, a diplomat. He should be vested with sufficient authority to do the job!

Building a building is not a short process, it is lengthy. A college's association with its architect will last over a period of years. Therefore, great emphasis must be placed upon mutual compatability. From a group of equal, technically-proficient peers a college should select the architect who seems most sympathetic to their needs, and with whom they feel they can work best.

How do we assemble that list of architects from which to make the final selection? There are a variety of ways: Find out who was the architect for that building that you admired so; talk to other administrators for their experiences. Usually, a list of ten or so architects, longer if necessary, can be compiled although that is more than sufficient. Initially from the list of ten to twelve architects, five or six can be quickly selected for a first interview. Usually one person will stand out as the right architect for a particular client. It is important to

visit his projects, not just look at the glossy photographs. If there are two who seem equally good, a final interview can be held. They may be asked to prepare proposals for their services to assist the committee in making its selection. Give consideration to the one who addresses himself to your problems and not just displays his own work.

To avoid confusion, do not talk to too many architects. It may be helpful to plan for the initial screening via brochures or written proposals. Concentrate on the individual architect, not just the firm. An important question is: "Will the Principals of the firm actually be involved?" Know exactly who you are getting. Since an architect must play a variety of roles, seek one who has broad involvements in all phases of the work, not just designability alone.

An open, receptive, intelligent individual would seem to be a good choice. Check his references. Visit his completed projects. Talk to his clients. It is important to know the man you are proposing to contract with. This may also apply to the key members of his staff assigned to work on your project. It may be advisable also to check the references of his engineering consultants. This would be particularly important if some special engineering services are involved in the project.

In spite of "turnkeys," modular construction and other recent developments, most building projects last for years! This is true, particularly, if you include the time and effort spent on

the part of the institution in planning its projects before an architect is hired and the project is put into execution. For the average project, an architect will spend anywhere from six months to one year in planning and producing the final contract documents. The average contractor will spend anywhere from six months to two years, depending upon its size, in constructing the building.

Careful scheduling can reduce this time period somewhat. Lack of scheduling can guarantee its extension. The college and the architect should jointly agree on a timetable at the outset of the project, and review it periodically. If the schedule is tight, critical events can be spotted ahead of time and decisions made so the work will proceed on schedule. Scheduling can be as simple or as sophisticated as required. Scheduling is a mutual task, just as the architect is obligated to do his work within the time mutually agreed to, so is the college obligated to make its key decisions as and whey they are required.

The architect's basic services, as outlined by the American Institute of Architects in their Statement of Professional Services, includes the following:

1. The Schematic Design Phase

   This includes conferences with the owner, after which the architect analyzes the project requirements and prepares schematic design studies. These consist of drawings and other documents illustrating the initial development of

the project for approval by the owner. Upon approval, of the schematic design by the owner, and the submission by the architect of a statement of Probable Construction Cost based on current unit costs, this phase of service is complete.

2. The Design Development Phase

Included is the development from the approved Schematic Design Studies of more detailed drawings and other data covering building appearance and structure, mechanical and electrical systems materials and such other essentials as may be appropriate. Included is the submission of a further Statement of Probable Construction Cost. Upon approval of the Design Development Documents by the owner, this phase of service is complete.

3. The Construction Phase

This phase includes the preparation of working drawings and specifications based upon the approved design development documents, describing in technical language the work to be done and the materials and equipment, workmanship, finishes required for architectural, structural, mechanical and electrical work, integrating site work and service connected or other special equipment.

During this phase the architect will also assist in the preparation of bidding information, proposal and contract forms, and Conditions of the Contract, covering responsibilities of the parties involved; he will also advise the owner of any adjustments to previous Statements of

Probable Construction Cost.

During this phase no essential change from the approved Design Development Documents should be made without the written agreement of the owner, with any indicated changes in construction cost being mutually understood. Upon completion of the Contract Working Drawings, Specifications and Bidding Documents, this phase of the architect's services are complete.

4. The Bidding or Negotiation Phase

Included is advice on the qualifications of prospective bidders if bidding is by invitation, and assistance to the owner in obtaining bids or negotiating proposals, and in the award of the construction contract.

5. The Construction Phase - Administration of the Construction Contract

Included are the following:

- Preparation of necessary supplementary drawings.
- The review of fabricator's and supplier's shop drawings; of the contractor's schedule of values and his construction schedule; of materials and samples and equipment and tests thereof.
- General Administration of the construction contract including periodic visits to the site to review the progress and quality of work and, in general, to determine if the work is proceeding in accordance with the Contract Documents.
- Checking the contractor's Applications for Payment and determining the amounts owing to the contractor, and issuing Certificates of Payment in such amounts.
- The preparation of Change Orders covering changes in the work approved by the owner.

- Determination of the Date of Substantial Completion and Final Completion; receiving and forwarding to the owner the specified written guarantees assembled by the contractor; and the issuance of the Final Certificate for Payment.

Please note that the architect does not "supervise" the work, but based on his on-site observations, he endeavors to guard the owner against defects and deficiencies in the work of the contractor. The contractor and not the architect is solely responsible for construction means, methods, procedures, and safety precautions. The architect is not responsible for the contractor's failure to carry out the work in accordance with the Contract Documents. If full-time project representation is required, and this is advisable on larger projects, a construction manager is usually hired by the college to work with the architect. (See Project Management Chapter.)

The architect's fee is usually a substantial one. It should be generally within the range of the recommended State Society of Architects Fee Schedule. Rather than seek a lower fee, it would be better to recognize his costs, pay the normal fee, and demand the highest standard of performance. The actual contractual arrangements between client and architect will vary with the scope and complexity of the job. There are three principal methods of compensation:

The first is the Percentage of Project Construction Cost. Under this method payment for basic services is a percentage of project construction cost. The construction cost for the purposes of computing the architect's fee does not include fees, cost of land or other costs which are the direct responsibility of the owner. Projects are usually divided into different groups according to their

complexity and size with a schedule of compensation for each group based upon construction cost.

A second method of compensation is a payment of Multiple of Direct Personnel Expense. This type of agreement is particularly useful when the scope of the project cannot be fully defined, or when unusual procedures for planning and awarding of construction contracts are expected, or where partial professional services are required. The architect is paid the payroll cost of technical personnel working on the project increased by an amount which covers his indirect expenses, overhead and profit. Reimbursable expenses are in addition to the payments covering technical personnel. A limit or "upset" amount may be mutually agreed in total.

A third method of compensation is the Professional Fee Plus Expenses. This provides a variation on the method described above. The owner and architect determine a lump sum fee for the architect's professional experience and availability of organization. The architect is also paid the payroll cost of technical personnel working on the project, increased by an amount which covers his indirect expenses and overhead.

Payments are generally made monthly as the work progresses. Where a Percentage of Project Construction Cost is the method of compensation, payments are made monthly against the various phases of the architect's work. These are:

Schematic Design Phase	15%
Design Development Phase	35%
Construction Documents Phase	75%
Bidding or Negotiation Phase	80%
Construction Phase	100%

While many laymen do not feel themselves competent to criticize an architect's design, nearly everyone has some strong feelings regarding budgets and costs. During the programming phase, the institution needs to accurately assess what it can spend in

capital outlay for a given project. This should be in general terms only, for the final detailed project budget should be arrived at in consultation with the architect. (See Chapter on Financial Analyses.)

In the preparation of the preliminary budget, a complete listing should be made of <u>all</u> the items that are involved in the project. These include:

1. Construction Costs

   a) Site development, including: utilities, landscaping, roads, walks, etc. _____

   b) Cost of building construction: Normally method of estimating preliminary costs is to calculate area or volume and multiply by a unit cost. _____

   c) Special or built-in equipment, not normally a part of the general building contract. _____

   d) Subtotal, building costs _____

   Project Subtotal: _____

2. Fees and Permits

   a) Architect and Engineers _____

   b) Special consultants: site, programming, landscape, interiors, acoustic, graphics, traffic engineers, etc. _____

   c) Legal fees _____

   d) Survey of site _____

   e) Soils and materials testing _____

f) Clerk-of-the-Works	_____	
g) Subtotal Fees:	_____	
Project Subtotal:		_____
3. Furniture, Fixtures and Equipment (this can be anywhere between 10-15% of construction costs)	_____	
4. Estimated Project Cost		_____
5. Budget Contingency, 10 per cent (Item 4)		_____
6. Probable Project Cost (Total 4 and 5)		_____
7. Interest and Financing Charges on (6)	_____	
8. Total Estimated Project Construction Cost		_____
9. Cost of Site Acquisition		_____
10. Total Estimated Project Cost		_____
11. Projections for Inflation @ _____% per year	_____	_____

This is a sketch of the normal components of a "project budget." This rather formidable list of costs serves as an illustration that the actual "bricks and mortar" costs are often only 50-70 per cent of the total project cost. If a tentative budget is established before the architect is hired, it

should be reviewed at once with him. There should be a mutual agreement on the budget with the achitect before he begins his work. This will avoid many unfortunate incidents later, where either party may suddenly realize that there was an earlier misunderstanding as to what something was going to cost. As in most things in life, an early and continuous and open contract will prevent many misunderstandings.

Once the initial project scope and budget have been established, the architect begins his work. This is generally divided into a series of distinct phases, as is reflected in the AIA Standard Form of Agreement Between Owner and Architect. During the first three phases of his work -- the Schematic, Design, and Working Drawings phases -- he is obligated to provide estimates of probable costs of construction. The architect generally does this by the area or volume method.

The institution would be well advised to require, and pay for a professional estimate of the probable cost of the project, as a supplement to the architect's estimate. This is money well spent and an analysis of these detailed estimates can suggest where savings can be made if this seems warranted. Some architects obtain an independent estimate of costs at each of the three phases. This provides them with a valuable check and assures the owner that due care is being exercised. The architect is usually responsible for his performance within a specific budget, and this procedure helps each of the parties understand the exact scope of the project costs.

A series of timely cost estimates, carefully revised throughout the preliminary phases of the architect's work is the best method of cost control. This should preclude the necessity for major surgery that is often exercised when the bids come too high. This sort of drastic reduction often acts to the long-term detriment of the school, the educational program that the building was to serve, and may, in some instances, void the goal that was to be achieved by the construction of the building in the first place.

There are construction management services that appear to offer major advantages in cost savings through certain kinds of project management. For the smaller building program their services often are not warranted. Essentially, they are duplicating the functions that the architect has been hired to perform. Like the architect, their background should be carefully checked and their methods of management, as well as their staff should be carefully weighed.

The construction manager should be employed at the programming stage of a project in order to permit him to work with the architect in developing the requirements that will govern the design of the project and the project budget. The employment of the construction manager after the completion of the project design is not recommended because his effect on the total project cost at this place in time will be minimized. Even though a construction manager may be able to reduce the cost of the

project through his capability of preparing bid packages as well as of managing the construction effort, the substantial cost savings will only be achieved during the design phase. The most appropriate time for selection of the construction manager is simultaneously with the selection of the project architect at the time the decision to undertake the project is made. Negotiated fixed-fee contracts are the preferred contract type for construction management. The fees paid for construction management services can be expected to range from two to five per cent and will vary inversely with the size, and proportionately to the complexity, of the project.

INNOVATION IN DESIGN

Two cliches are constantly being used in the architectural field: Cliche No. 1: All buildings must be user-oriented; Cliche No. 2: Form must follow function. There is no disputing the validity of these concepts. Obviously, if a beautiful building is created out of context with those who use it (faculty office so small that he cannot advise students; secretary who's desk must face only an easterly or westerly window, etc.) it will be ineffective. Obviously, too, the building must have a close fit to the activities anticipated to go on within it (expensive wet labs where computer simulation of experiments is widespread, for example) it will be inefficient.

We all like to think we are creative, especially as we approach building design. In a fantastic number of cases, however, creativity is no more extensive than minor adaptation of previously achieved solutions. The greatest barriers to creativity are: 1) lack of comprehensive information on user needs, and 2) lack of perceptual horizons broad enough to consider truly radical alternatives before settling on THE approach. This section is devoted to considerations on how to overcome these barriers and to introduce creativity in the planning process.

First, let's examine the planning process by which initial inputs are gathered. Generally, we make use of committees. On some campuses there is one Building Committee that meets to work on all building plans. The group remains essentially the

same over time and while it appears to be representative of campus constituencies (trustees, administrators, faculty and deans) it is normally narrowly constituted. This is a pragmatic approach since the group gains in experience each time it works on a building, it has the elements of at least being representative, and the group remains of a manageable size. Unfortunately, no small group can be truly representative, therefore, a great many vital ideas remain still-born, invisible. Another committee approach is to name a building committee for each separate new facility. This allows proportionately greater representation from the basic user group, while maintaining the advantages of the committee structure mentioned above. While total group experience doesn't grow, a small cadre of administrators generally have a seat on all such committees thereby providing experience and continuity. Again, however, the representation factor is limited to some extent.

If we are seriously concerned by user needs and therefore desirous of having broad representation in the planning process, what are some approaches we can take? Among the possibilities are:

1. Town-forum or suggestion box approach. All interested persons have an opportunity to make inputs. Generally, however, only strongly motivated -- negative or positive -- persons become involved, thus not ensuring truly diverse inputs leading to polarization.

2. Professional behavioral studies. This is a costly process, but many institutions and architects are making more and more use of behavioral studies, justifying the cost on the basis of better facility use in the end. Interviews, questionnaires, and observation techniques are employed to obtain a thorough analysis of needs (actual and perceived) and desires of user groups.

3. Surveys. Planning committees structure a questionnaire to be given to user groups and report tabulated responses. Generally, these questionnaires are narrowly and unprofessionally constructed and administered, frequently to the point where the only outcome is to validate the committee's own thinking process (it should be pointed out that although this occurs frequently, it most often is an unconscious act).

4. Delphi method. Perhaps the most effective and easily administered tool for determining group consensus is the use of a technique developed by RAND Corp. originally for technological long-range forecasting. Called Delphi, the method does not depend on normal statistical sampling methodology and the questionnaires used are derived from the panel group itself by use of content analysis. The tool can be used for forecasting (necessary long-range planning inputs), value analysis (necessary for quality and communication inputs), objective articulation (both for long-range and short-range program planning inputs), and for consensus formation (agreement/disagreement intensities on items). Use of the technique allows everyone an equal opportunity to make significant planning contributions, without elaborate or expensive feedback and processing delays. (See bibliography.)

By use of one or more of the above techniques, strong patterns of user needs can be determined and program planning inputs can be arrived at without undue delay caused by "semantic noise" or political obfuscation. Next we must consider expanding the perceptual horizons of our planning committee, in order to ensure that a broad continuum of alternative solutions are properly considered rather than merely rubber-stamping a project design.

As humans we all have a tendency to look backwards in attempting to consider the future. For example, it has been said that the North Atlantic Treaty Organization was established following World War II in order that we could properly fight World War II

if it should ever occur again. We build fixed, elaborate wet labs extensively in science buildings, yet we forget that computers can simulate most of these experiments and provide a greater range of alternatives, and when physical experimentation is necessary experiments can easily be handled in scaled-down processes making use of portable equipment. By taking the wet lab approach, it is possible that we are designing a science facility to better teach our students chemistry should they ever need to learn pre-1940 chemistry.

As humans we are also victims of a fairly rigid mental set. For example, a man who has been imprisoned over a period of years in a cell 15 paces by 15 paces will, upon release from imprisonment, be seen to pace 15 by 15 even though he is in a large spacial environment, such as a living room or ballroom. All of us pace "15 by 15" when confronted by problems at one time or another. Double-loaded corridors in dormitories, blackboards in theaters, Georgian exteriors on ultra-modern internal facilities, window, bricks, doors, and so forth are among examples of our straight-line thinking processes.

The first element in approaching our building solution creatively (and adherring to the "form follows function" rule) is to indeed know what program or programs are to go on in the facility. This is detailed program planning. What are the educational objectives of the program and what are the resource requirements (in things not dollars) necessary to meet those objectives best? What is the program's strategy (high-technology, independent

study, close personal student/teacher interaction,etc.)? When we know these basic building blocks, we can begin to play with them, arranging and re-arranging them into myriads of patterns. At this point do not interject "reality" cost constraints, etc. into the discussion. Allow the planning committee to free-wheel with the building blocks of the program that have been articulated. The range of alternatives should extend from achieving program objectives through the use of no additional new facilities to possibly abandoning the old campus and building a total new one. The process here is that of group "gaming out" of possible models to follow. At right is a conceptual model for completely changing a campus, a series of such models should be grappled with by the planning team. To use such models for perception expansion, give planning members copies of some models for discussion, work through each model filling it out in as much detail as possible; as particularly interesting ideas occur jot them down on paper easel for later "real" use. When interest wanes on any particular model, go on to another.

Encourage team members to generate their own models for group consideration. Benefits of this process include team building in a constructive, critical mode (no one can make a negative comment without also providing a positive contribution); loss of inhibitions in proposing ideas no matter how unusual; a sense of consensus among planners concerning global objectives, and a reservoir of ideas for inclusion in formulating the institution's own model.

MODEL: INVISIBLE, DISPOSABLE, TRAVELING COLLEGE

It is possible to teach thousands of students with a very small, permanent facility for administration, instructional materials, and some high technology instructional space. The campus: space at an airport, factory, storefront, hotel suite, or mobile units. The college would use community materials and facilities -- an aerospace company's numerical control mechanisms, an electronic company's labs, a construction company's heavy equipment. In return, the college would look for and provide services that are needed in the community -- staff a day-care center, man hot-lines for a crisis center, provide paramedical aid at hospitals.

As part of this model, youth hostels could be created as outposts of the college. Their resident manager could be a student who is studying logistics or who must be in the location to do independent study. The hostel would provide discussion space, a computer terminal, supplies for minicourses, a learning resource room, and faculty locations. Hostels would be located to correspond with areas of study and would be open night and day.

The permanent central facility would service mobile units, provide teaching materials on demand, act as a scheduling center, answer questions by radio or video, and generally stimulate and service all outlying units, fixed or mobile. Commercial enterprises could be given space at a central location in return for instruction of students. Any single units of the college could be discontinued and re-formed at any time.

A collegium of from 50 to 150 individuals (students, faculty, experts) could be formed in any subject area which can be communicated by mail, audio-cassette or telephone either spontaneously or at predetermined times. The information and acquaintance network of each student and professor would expand geometrically, contributing expertise from around the nation and the world. The system is inexpensive and can change as needs change.

This model has implications for savings in capital investment for construction and for attracting faculty and students who are widely separated by geography.

Another way to achieve initially some of the same creative objectives would be to introduce a problem-solving exercise. For example, break your planning team into smaller groups. Provide these groups with a box of Tinker-Toys each. Allow the groups to examine the Tinker-Toys for a time and then replace them in the box. Now give the teams the same objective (problem): Build the tallest self-supporting structure possible from among the materials in your box of Tinker-Toys in 10 minutes. There are dozens of ways to approach solution, and to win the game, but the team simply stringing the materials together and hanging the structure from a ceiling fixture is exhibiting the pure elements of creative problem-solving -- they have broken through a perceptual barrier. Most other solutions will be straight-line thinking approaches.

After creative program planning has been achieved (the why of a building) it is time for the team to use their newly gained creative abilities on the building itself. Ask the team to define a building. According to Webster's dictionary "...a building is the general term applied to a fixed construction with walls and a roof..." Is this or similar permutation of definition sufficient for your program planning purposes? Is a plastic bubble fixed in place over a park a classroom building? Is a structure of steel girders capable of housing dozens of mobile units in five stories an office building? It has no walls, no roof. Again the effort is to allow for a truly wide variety of architectural solutions to our program needs.

In this way the building (form) will indeed follow program (function). Now is the time for the team to review some of the possibilities available to them in construction, after all we are building a structure for tomorrow and construction techniques have grown widely.

First, let's look at the basic building blocks with which designers may work: design concepts. No matter the project, these design concepts will enter into any phase of thinking about your project.

ACADEMIC PROGRAMS

Earlier in the planning process you will have derived several critical elements regarding your academic programs to be housed by the facility under consideration. In this process you will have discovered that academic programs are generally structured about essentially one of two basic orientations: function oriented or discipline oriented. In the case of academic programs that are structured around a functional orientation, facilities are grouped according to their specific uses (e.g. laboratories grouped in one area, classrooms grouped in another). A discipline oriented plan groups facilities according to the colleges they serve (e.g. the College of Liberal Arts would find all its classrooms, faculty offices, laboratories, etc. in a single area). You will next want to consider whether the type of building under consideration is for common use (student unions, book stores, etc.) and whether a centralized or decentralized function is necessary; you will also be considering whether it

is a support function (housing, greensward, utilities). All of these building blocks are important in considering facilities locations.

CIRCULATION

Will the building be involved in a high traffic flow (and traffic flow involves pedestrians as well as automobiles)? Is the campus pro automobile? Circulation internally also involves the horizontality or verticality of the building. A ten-story building and a 200 foot long building of one story may take the same "commuting" time, but traffic congestion may occur in radically different places.

BUILDING DENSITY

Consider your policy decisions with respect to the direction in which a campus will grow. Selection of either a vertical or horizontal theme will have an effect on the coverage and bulk or spacing of buildings (and necessary traffic support facilities).

INTANGIBLES

You will want to consider flexibility ("the capability of responding or conforming to changing or new situations") and expansion ("the ability to accommodate growth") in your design. How important are they? What priority do they have in your plan? You will also want to consider the aesthetics of any design also. Is it attractive? Does it suit the institutional personality?

Obviously, the permutations of these basic design concept blocks are numerous -- all will play a role in creative design.

Next, let's turn to some radical building solutions which might be considered. Again, these are included in the manual only to expand perceptions of possibilities which may or do exist for potential adaptation on your campus.

COLLEGE IN THE CITY

"Instead of building scenic plants like Dartmouth," says Detroit architect Peter Tarapata in the September 1971 issue of College & University Business, "architects will be building colleges in the cities. They will be of good size, but the cost of land will be very high, thus necessitating high-rise type buildings." Thus approach entails the design of an integrated campus in the city, another approach that is possible -- if cities are seen as where the action is, and there is some doubt -- would be to merely rent or purchase urban locations scattered all over; remodeling and renovation would be the capital costs.

COLLEGE AND THE ENVIRONMENT

"As the barrage of problems of the world increases on the individual, says Seattle architect Bill Bain, it will be the architects' duty to create a contrast -- a simple, functional design complemented by skillful landscaping." Almost as a return to the past, in the future the total outside environment may be more important than the buildings themselves.

COLLEGE AND ELECTRONICS

Extensive utilization of electronic communication equipment -- radio, telephone, video, computer -- makes for radically different space utilization loads and space configurations.

COLLEGE UNDER ONE ROOF

The U.S. Pavilion at Expo 70 in Osaka, Japan, was a space 465 feet long and 264 feet wide which did not require a single structural column to support the translucent roof. This was accomplished by using an air supported structure. A slightly higher air pressure inside the building carries all the loads that would normally be supported by massive columns, beams and arches. Such an enclosure can easily be made to cover a space a mile wide or five miles wide without significantly increasing the weight of the structure or the cost per square foot of area enclosed.

A second approach to putting a college under one roof is the so-called megastructure, one large all-encompassing building generally constructed with traditional materials. More and more shopping centers are being constructed in this fashion -- Woodfield in a Chicago suburb covers some 230 stores and shops under one roof -- .

MODULAR CONSTRUCTION

It is possible now to purchase separate major components of a building and piece them together in any configuration you please. Another possibility is using mobile-home like structures and

arrange them in a high-rise garage-like structure in any configuration you choose.

DISPOSABLE CAMPUSES

Some institutions are finding it desirable to create inexpensive buildings with a short-range obsolescence built into them -- it certainly gets around the "flexibility" problem, but it frequently creates expensive maintenance problems.

This is only a partial listing, but a little research and discussion will open up a bright range of possibles for consideration.

One last note on creativity -- best utilization of committee time. Frequently, our committee is faced with the task of doing detailed work, work normally assigned to a staff. Because of this work load, the planning committee is never allowed the luxury of using some of the creative activities mentioned above. At the same time, because there are so many different studies to perform and questions to be answered, the committee is forced to make reports which are not as detailed as would be desirable.

Why must a committee be looked at as a finite structure, incapable of producing beyond its limited resources? Is this detailed investigation a logical load for the committee to assume in the first place? We can take an approach which assumes a planning committee that must do these studies, however, the group does not have to work on the same problems together. One approach would be to appoint Task Forces to study separately each area of

investigation, with a planning committee member acting as chairman of each Task Force. Now we can add internal staff with required skills to each specific Task Force, when its study is complete the Task Force self-destructs and new ones take the place of old ones. This allows for greater utilization of internal professional skills (mathematicians, sociologists, psychologists, etc.) which might otherwise be costly or not used, and it also provides for a meaningful participation format for larger numbers of people without the onus of being assigned to yet another committee in perpetuity. Finally, the process is dynamic and unlike most committee assignments in the problem-oriented task force approach participants can see the outcomes of their deliberations.

ACADEMIC HARD HATS: PROJECT MANAGEMENT SYSTEMS

All of the efforts described thus far -- planning, organizing, scheduling -- are all preparatory to the actual implementation of a building project. Each and every one of the preceding steps are necessary preludes to putting a spade into the ground; they significantly increase the likelihood of having made correct decisions, facilitating actual construction. It is now time to again plan, organize and schedule, this time specifically for the purpose of construction. While any set of words might adequately describe the process, we will use the term "project management."

There are many ways of approaching construction management: 1) let the architect do it, 2) let the contractor do it, 3) let a committee oversee it, 4) hire a specialist for the project's duration in-house, 5) create a project management team, or 6) do nothing at all. It is the advice of this manual to indeed create a project management team within the development office purview. The common characteristics of this approach are:

1. development of the construction concept concurrently with development of the design concept;
2. continuous cost estimation (related to market place conditions; and
3. site supervision of construction -- all in the hands of an institution employed construction manager.

The intent of this approach is to greatly reduce facility delivery time by phasing together the design and construction phases of the project. Even when such phasing does not occur, the

benefits of site managership in the hands of an institutional employee -- if qualified -- have been found to be successful, especially if a team approach is used.

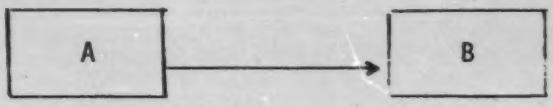
The pay-offs for the use of a tight management team approach to construction are well cited in "Construction Management/Phased Design and Construction," published by the Facilities Engineering and Construction Agency of H.E.W. in 1971:

> "In the team approach, each member of the team will have precedence and exercise leadership in his own sphere of operations. In accordance with this principle, the architect/engineer will have prime responsibility for concept, functional use of space, aesthetics, and excellence of design. The construction manager's role during the design stage will be that of advisor on material costs and construction methods and their costs; however, as the member of the team primarily responsible for the project cost, the construction manager will exercise overall budget control.
>
> "Adding construction management talents to the design team enhances the architect's design capabilities by providing knowledgeable consultation in the areas of construction costs, materials and methods construction, manpower utilization, and scheduling of the work. It allows the architect to devote his energies to those things for which he is most adequately trained and experienced, with reasonable assurance that his work will culminate in a project within the prescribed budget and within the selected time span. It relieves the owner of many of the anxieties that usually beset him, particularly those concerned with adequate financing and timely completion. Finally, the construction manager can provide that vital connecting link between the designer and those who will be bidding the work. The coordination provided by the construction manager should preclude many of the conflicts and resulting expensive change orders which are prevalent in the traditional contracting method."

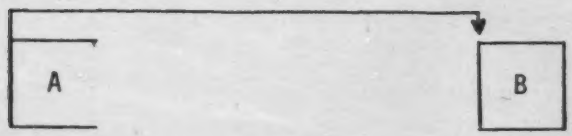
Before going into detail on the specific functions of your project management team, let's review the concepts which

underlie this concept or any other "systems" concept of project management.

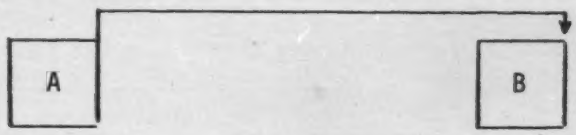
It has become popular to discuss almost any managerial problem in terms of systems analysis. Management systems and project systems and critical path systems are the kinds of things referred to. No system, no matter what its name, is any better than the effort put into it. Any system, conscientiously worked out, will work. But certainly one of the popular ideas that has a great deal of application to campus building projects is based on "precedence networks" and the analysis of same. For example, it is obvious that there are three possible sequential relationships between any pair of activities, A and B. The first is:



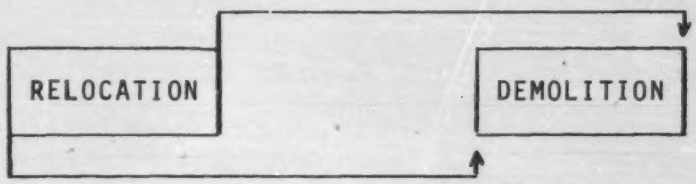
This is the "finish-to-start" kind of relationship which says that work activity B cannot begin until work activity A has been completed. A good deal of manufacturing is like this, you cannot grind something smooth until after it has been cut to shape, for instance. Some careless thinking has been in evidence in construction project management in certain cases where the assumption has been made that a following job could not begin until the preceding job was completed. It is certainly true that you cannot paint a wall that is not erected yet, but not all the walls have to be up for any painting to begin. This brings us to the second relationship.



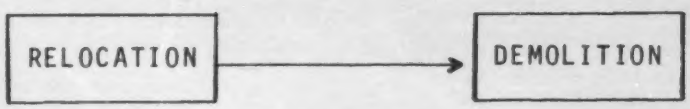
This is the "start-to-start" relationship which indicates that work activity B can begin anytime after work activity A has started. The third relationship is the "finish-to-finish" form which requires that work activity A be completed before work activity B can be completed.



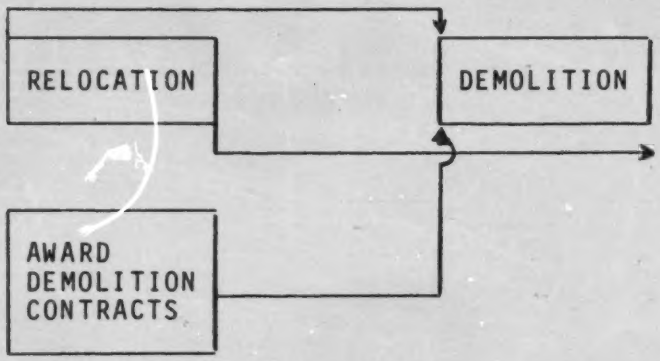
Actually, it is worth considering what is involved in coupling together the second and third forms of relationship, as shown in the diagram below:



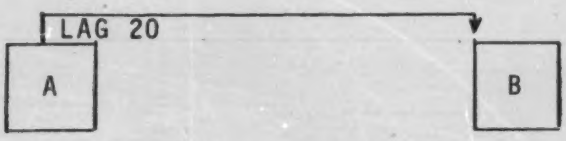
and contrasting this with the first diagram. Note that clearly there will be time saved by the figures above compared with the figure below:



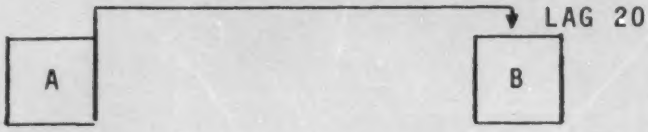
Let us suppose that one of the possibilities in a campus building project is a replacement of World War II "temporary housing" that now is used for married graduate students. As the preceding figures indicate, these married graduate students must be relocated before demolition of the old structure can begin, let alone a new married student housing complex erected.



One more basic idea is important to understand. It is the idea of "lag." If work activity B can begin 20 days after work activity A has started, this can be shown as:



And if B can end 20 days after A has been completed, it will look like this:



Whether the system is called PERT or CPM or some other less well known set of letters, is less important than that the individual or service company proposing to use this system have some experience and capability at this kind of approach. It is not sufficient to read a book the night before and then begin applying the idea of precedence networks. One well known firm, Barton-Ashman, suggests that the project manager and the management system must mesh to provide:

"1. A capability for arriving at, and evaluating the realism and feasibility of precise project objectives and target dates.

2. A capability for arriving at schedule assignments both appropriate to the adopted objectives and realistic in terms of resources available.

3. A capability for monitoring and evaluating the performance of each project participant within the framework of adopted project objectives.

4. A capability for quickly responding to schedule overruns with new assignments appropriate to project objectives."

Still another planning consultant, Candeub, Fleissig and Associates, suggests that the major components in project planning involve a preliminary and then an operational model concerned with the existing financial staff and technical resources, the workload in each functional area together with any special problems that are anticipated and agreement as to the general schedule for the completion of the project activities. Still another firm, CIT Educational Buildings Inc., has built a business out of providing the funds, the design, the construction, and the supervision.

Now, it may occur to the reader to ask himself just how much of the best that is known about project management and the general subject of systems applied to construction projects is it reasonable for him to know? To what extent will the costs of hiring a specialist pay for themselves in terms of savings, time, money and anguish? Each institution has to answer that kind of question for themselves. It really turns on what values seem paramount. If the president or chief executive is going to have things his way, no matter what a project manager, a PERT expert, or the like may recommend, then there is less value to putting a professional in charge of your next project. It is not very likely that any administrator who would be likely to interpose his judgment in place of the judgment of a professional, will take the time and trouble to learn anything that will change the course of events.

In terms of self-learning, there are a number of sources that suggest themselves. One of the best for presidential or vice-presidential reading is a booklet available without charge to educational institutions from the University of California at Berkley entitled Management Contracting at the University of California. It was written by James F. Abbott, formerly coordinator of construction and maintenance at the University of California. He is now Vice-President of John Carl Warnecke and Associates of San Francisco, California, a firm or architectural and planning consultants. A brief description of the management contracting idea appeared in College and University Business magazine in the August 1971 issue.

Management contracting:

> "...is accomplished through public advertising for prequalification of interested contractor, soliciting of competitive bids from them, and using the winning contractor's competence in estimating and value engineering in the development of project working drawings. The overall time for the building process is reduced by overlapping the design and construction phases."

The term "value engineering" needs some comment. As pointed out earlier there are frequent trade-offs possible in any building project. The task of the management contractor or the supervising architect must be in part to determine what materials, designs, etc., will satisfice, yes, that is the right word. In some undertakings it may be possible to optimize, but usually the best that can be achieved is satisficing! The point of value engineering or value analysis is to scrutinize every possibility for less cost and yet equal performance to the more expensive alternative in terms of the real need.

The mechanics of management contracting can be better visualized from the following excerpt from the CUB article cited earlier:

> "One especially important legal decision was that general contractors could not be preselected but must be permitted to bid under publicly advertised competition. To accomplish this, an advertisement was published inviting all interested contractors to submit specific financial, surety and insurance information. The information was then evaluated using a previously established point system, under which a contractor scoring 30 or more points out of a possible 38 points was determined to be "prequalified."
>
> An advertisement for bids was then published calling for proposals for the prequalified contractors in terms of fee percentages, sharing of savings, and cost of preconstruction consultation based on an estimated construction cost listed in the advertisement. These bids included the base fee covering

> that work performed by the contractor's own forces and another fee covering work performed by his subcontractors, the cost of the performance bond, workmen's compensation insurance, indirect job labor burden, and finally, shared savings.
>
> After bids were taken, they were evaluated by converting the contractor's percentages to dollar value. The contractor whose bid showed the lowest net cost to the university was considered the low bidder."

Obviously, the consequence of this kind of partnership in construction is to take the action away from the typical architect and place it in the hands of a management contractor.

It should be obvious from the array of choices discussed in the preceding excerpt that there is no single, best way to proceed with the building project. Almost any endeavor to implement some system into academic building projects should have a favorable outcome, since compared with almost anything that is thoughtfully proposed, the old method is definitely second-rate. This does not mean that all of the construction projects that have not had the benefit of modern analytic methods were poor values. Not at all. In fact, a good many very shrewd administrators, presidents and vice-presidents, usually, knew instinctively what the modern analytic methods make explicit. Where a college or university is fortunate enough to have this kind of expertise on board, there is clearly less need for the methods described herein. Usually such men are the very ones who are most interested in new approaches since it gives them something to test their innate know-how against. The purpose of the facilities manual of which this is a part is to make explicit what especially knowledgeable administrators have known or come to learn.

No matter the final means of providing construction management, there are several functions which must be considered essential:

1. Formulation of the Project Budget. Much of this information has already been detailed in your financial analyses and gross project cost estimation analyses. However, detailed project costs must be created, monitored, and changed as the project progresses. Careful attention to budget control, especially regarding cash-flow and cost over runs, is most important.

2. Technical Consultation. Frequently, an independent, in-house voice must be heard when it comes to making critical choices in the utilization of materials, products, and construction techniques. While the project management team should not infringe upon the design responsibilities of the architect, it should be in a position to make responsible recommendations in behalf of the institution, especially as alternatives relate to cost.

3. Preparation of Bid Packages. Upon completion of final working drawings, preparation should be made for developing the bidding documents necessary for the project. A detailed description of the bidding process is contained elsewhere in this manual.

4. Preparation of the Bidders List and Invitation for Bids. Complementary functions of the bidding process mentioned above and in the bidding chapter.

5. Scheduling for Project. The project management team can and should have a significant impact on the project in terms of scheduling the work to be done. This process is closely coupled with the bidding process and early cost estimating requirements.

6. Accounting Records. The project team should maintain or closely assist in maintaining financial and cost accounting records for all costs associated with the project.

7. Supervision of the Work. Obviously, the most important function of the project management team is the supervision of work to be performed on-site. Some of the basic services here include: coordinate the separate contracts, monitor and separate phases of work to see if they are on schedule, adjust the work to accommodate changed conditions, inspect workmanship, material and equipment as to conformity to approved contract drawings and specifications, prepare work progress reports, monitor progress payments, record all changed work that deviates from contract documents.

This list is by no means exhaustive but is representative of the types of services that the project management team may be expected to perform.

While these services might well be contracted to an outside firm, an institution can not escape the final responsibility of being meaningfully involved in the actual construction project, even if a project utilizes the "turn-key" approach.

BIDDING AND COMPLETING YOUR BUILDING

Once all the planning is done, the architect has designed your building, preliminary and detailed cost estimates have indicated you have a feasible project, and the financing arrangements have been made, you are finally ready to build! If your project is not, at least in part, financed with Federal money, you have probably already shopped for a contractor and he has been part of the final planning and estimation stages of the project. If, however, your project will use Federal money, your project must be competitively bid.

The preparation of competitive bid documents is an important service provided by your architect. The documents released to prospective bidders must be a complete engineering description of your proposed project. Any errors, either of omission or commission, are first the responsibility of the architect but finally the responsibility of the owner. It is the owner that must pay for the corrections via change orders during the course of construction. The appropriate Federal office will review the bid documents, however, their approval merely says that the necessary forms are present and that the project generally meets the guidelines and specifications applicable to the project.

The Contract Documents or Bidding Documents usually contain the following individual documents (Both H.U.D. and H.E.W. require almost identical documents):

1. Advertisement for Bids.
2. Information for Bidders.
3. Bid Form for Lump Sum Contract.
4. Bid Bond.
5. Contract.
6. Performance and Payment Bonds.
7. Certificate of Owner's Attorney.
8. General Conditions.
9. Supplemental General Conditions and Federal Wage Rates.
10. Special Conditions.
11. Technical Specifications.
12. Drawings.

Advertisement for Bids. Construction contracts should be awarded through competitive bidding and all qualified bidders should be sought. Notice that the necessary bid documents are available should be placed in at least the local newspaper and in a trade publication such as the Dodge Reports. Placement in the Dodge Reports can be made by contacting your local Dodge Plan Office (consult your telephone book). Under the HUD programs, prequalified bidders may be arranged, especially in a "turnkey" project,and documents can be sent directly to these prequalified bidders. In the advertisement a brief (one sentence) description of the project is usually given as well as the location(s) where the documents may be obtained, and the location and date and time the documents must be submitted to the institution.

Information for Bidders. This contains the formal notification of the place of delivery of the completed bid and the deadline for submission. It also states the waiver and rejection rights of the institution and the clause binding the bidder to the facts and figures he submits for a period of thirty days. General instructions for completing the bid documents; guidelines for the bid securities; qualifications of the bidders; liquidated damages; conditions of work; acceptability of subcontractors; notice of special conditions, and the method of award are also contained in this document.

The institution may decide to request a base bid and an alternate bid. The alternate bids work as follows:

Base Bid -- if the lowest bid is within the allowable budget, the project is awarded to the lowest bidder.

Base Bid plus Alternate Deductive Bid -- if the base bid is not within the allowable budget, certain alternates may be specified and priced separately, thus if the base bid (containing all the alternates) is too high, alternates can be removed until the price falls within budget.

Base Bid Plus Alternate Additive Bid. This option is used when the institution desires more of a project than the financial forecasts indicate it can afford. The additional portions of the project are listed in order of their priority. If the base bid is below the maximum allowable budget, the alternates can be added until the maximum level is reached. Careful analysis of the bids is required here as the lowest

base bid may not be the lowest bid when the additive alternates are included in the project.

Bid Form for Lump Sum Contracts. This form is the formal response of the contractor to your project advertisement. It contains his price for the project and any alternates you may have specified. It also shows any unit prices you may have requested. Unit prices may be requested (sometimes in the form of a Classified Bid) for work items where quantity is an unknown. For example, if the borings indicate that a substantial amount of ledge will have to be removed, the technical specifications may suggest the anticipated amounts which the contractor would figure into his Lump Sum Bid and a Classified Ledge Bid would indicate the cost per unit (in cubic yards) that would be charged to remove ledge in excess of that specified in contractor's Lump Sum Bid.

The Lump Sum form also contains the amount of bid security accompanying the bid. This security may become the property of the institution if the contract and bonds are not executed within the specified time limit. This security would then become liquidated damages to help the owner recover for the delay and additional costs caused by the contractor.

If your institution is in the process of developing two or more projects, there are a great many advantages to soliciting a combined bid for the various projects as well as bids for individual projects. There may be some savings realized if

one contractor handles all the projects because with one contractor you would not have to support the overhead of two or more competing firms. The procedure is the same as described above except you will request a combined lump sum bid. You are not bound to accept the lowest lump sum bid if two or more individual bids from competing firms are lower than any one combined bid, however, the advantages of having to work with only one contractor combined with the usually lower costs present an extremely beneficial package to the institution.

Bid Bond. This document, with the accompanying documents from the surety company, represents the surety presented by the bidder to the institution, certifying the availability of the funds in case the contract is not executed for reasons of the contractor. Note: HUD recently added an addendum to the qualifications required of the surety company -- surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570) and be authorized to do business in the state in which the project will be built.

Contract. This is the formal and legal document binding the contractor to build the project and the institution to pay for it.

Performance and Payment Bonds. These bonds, which may be in the form of a Performance Payment Bond or separate documents, protect the institution financially in the event that the contractor fails to pay any person, firm, sub-

contractor or corporation furnishing materials or performing labor on the project (Payment Bond) or fails to perform his duties, all the undertakings, covenant terms, conditions, or agreements contained in his contract for the project (Performance Bond). These bonds insure that the project is built under the conditions set forth in the contract, whether the contractor is able to complete the project or not. For example, in the case of bankruptcy on the part of the contractor, the proceeds of the bonds would be used to finish the job, or if the contractor became bankrupt after your project was completed and he had not paid his subcontractors, the proceeds of the payment bond would be used to pay the subcontractors thereby preventing liens on the institution.

Certificate of Owner's Attorney. This is the written opinion of the institution's legal counsel that the contracts and bonds presented by the contractor have been executed by the proper parties and that the documents appear to be valid and legally binding obligations upon the executing parties.

General Conditions. The General Conditions are basically the operating rules for and responsibilities of the contractor and are attached as part of the contract. They cover such things as: Contractor's Title to Materials, Inspection, Time for Completion and Liquidated Damages, Claims for Extra Cost, Construction Schedule and Periodic Estimates, Insurance, Use Prior to Owner's Acceptance, Payrolls and Payroll Records, Apprentice, Compliance with Copeland Anti-kickback Act, etc.

Supplemental General Conditions. These are also attached as part of the contract. The Supplemental General Conditions enumerate the plans (drawings) specifications and any addenda that form part of the contract. They also specify any special hazards that the Contractor's Public Liability and Property Damage Insurance must provide protection against and the amounts of that coverage.

The Schedule of Occupational Classifications and Minimum Hourly Wage Rates also appear in this section. The law requires that Federal Minimum Wage Rates must be paid on Federally assisted construction projects valued at more than $2,000.-. This ruling is covered by the Davis-Bacon Act. Wage rates are determined by the Department of Labor but must be requested through the agency supplying your financial assistance. A minimum of 45 days is usually required for the delivery of these rates and they have to be available to the contractors during the bid period. The wage rates are regionally adjusted and are time-bound; that is, they contain an expiration date and the contract must be awarded before that expiration date. An award of a contract after the expiration makes the contract invalid. A redetermination of the wage rates must be requested if the contract will be awarded after the expiration date.

Special Conditions. These are just what the term implies -- conditions affecting the contract or the project which are not contained in the General Conditions or its Supplement.

Technical Specifications. These are the architect's specification of materials, equipment, procedures and conditions that are acceptable for the contract and the project. The Technical Specifications usually cover such things as site-work, concrete, masonary, metals, carpentry, moisture control, doors, windows and glass, finishes, specialities, equipment, furnishings, mechanical systems and electrical systems.

Drawings. The Drawings are the graphic presentation and generally follow the outline of the Technical Specifications.

The bids should be opened publicly and the amounts read aloud. Your architect and your attorney should be present for the opening.

After the opening, your architect and/or project management team must carefully analyze each bid to insure their completeness and your lawyer should also review them to insure their legality. The bid most advantageous to the institution (usually the lowest bid with the exceptions noted above) is then forwarded to the appropriate Federal office for their concurrance. Upon receipt of this concurrence, the contracts accompanying the winning bid can be executed and a "notice to proceed" forwarded to the contractor.

Prior to the start of construction, the institution must schedule a preconstruction conference with the appropriate Federal agencies. The architect and the contractor must attend

this meeting as the Federal requirements during the construction phase will be discussed.

The institution should start a project document file containing the following elements: construction accounts, payroll records, monthly progress reports, monthly requisitions, change orders and general correspondence. These records will be essential documents during the final close-out procedures with the government.

It is generally the applicant's responsibility to provide inspection and supervision during the construction. This inspection and supervision is to insure that the project is being built according to the plans, specifications and contract documents. The architect normally provides the central administration of the project and periodically visits the site to review the quality and progress of the work. It should be noted that the architect does not actually supervise the work but insures the quality called for in the contract. For large or complex jobs a Construction Manager/Clerk-of-the-Works retained by the owner should be utilized. This individual will be the owner's technical advisor and works both with the architect and the institution to supervise the construction.

Monthly construction reports should be forwarded by both the contractor and the Clerk-of-the-Works to the institution to provide information on the progress of the work and compliance with the contract. H.U.D. has recently discontinued its

insistance on detailed monthly reports, however, the Office of Education continues to require them (Form OE-8045). It is recommended these reports be filed regardless of Federal guidelines as they are the substantive progressive analysis of the project. In projects containing more than one building, the monthly progress reports should cover only one building at a time. This individualized reporting system eliminates many headaches at the end of the project, and clearly identifies any non-compliance situations. This is important as failure to correct a non-compliance situation could result in the withholding of Federal assistance to the institution. The monthly progress reports should indicate the project's position on the project's PERT or CPM chart if these scheduling techniques are being used.

Partial payments to the contractor are usually made on a monthly basis. The contractor should submit a line-item requisition to the institution. The architect should then review the requisition and verify that the work detailed on the requisition has, in fact, been completed and that the quality is acceptable. Clerk-of-the-Works reports should also be reviewed in the analysis of the requisition.

The institution should exert its rights of retainage at the onset of construction and a mutually agreed on percentage of the total contract cost (usually 5%-10%) should be withheld pending satisfactory completion of the project. This percentage is applied directly against the monthly requisitions.

The retainage held to the end of the project provides the institution with a financial bargaining tool if deficient conditions exist at the end of the job.

To make changes in the project, whether these changes are additions, deletions or upgrading of specified materials or equipment, a written change-order procedure should be followed. If, in the opinion of the institution and the architect, a change in the technical specifications or design of the project is necessary or desirable, a written request is made of the contractor for price to complete the described work. The contractor replies with a written statement quoting his price to make the change. If the price appears to be reasonable, the architect can then advise the institution to authorize a change-order. However, if the architect considers the price to be too high, he can reject the contractor's reply and negotiate the cost with the contractor. If the change-order is approved, it is added to the monthly contractor requisition and the retainage rate is applied by the institution. Most change-orders do not require Federal concurrence, except those that alter the contract conditions, affect the project's safety features, or changes the project's scope by more than 5% (increase or decrease of the project's assignable area). One note, architects are compensated for their activities concerning change-orders at a percentage of the worth of the change (usually 7%). In the case a change-order instructing the contractor to upgrade a particular building material or piece of equipment,

a credit may be given for the material not used thereby resulting in the institution paying only the difference in cost between the two types of material or equipment.

For construction projects which are Federally assisted, the contractor is required to maintain payrolls and basic records during the course of the project for all employees and employees of all the subcontractors working at the site. The records must include: the name and address of each employee, his correct classification, rate of pay (including rates of contributions for or costs assumed to provide fringe benefits) daily and weekly number of hours worked, deductions made and actual wages paid. The contractor must make these records available to the institution and the architect should review them.

The contractor must also deliver to the institution a weekly copy of all payrolls accompanied by a signed statement indicating that the payrolls are accurate and complete and that the wage rates contained in the payrolls are not less than the wage rates established by the Labor Department for the project. The architect should verify these records. If an individual has been paid a rate less than he is entitled to, the difference must be paid him by the contractor. All payroll errors must be reconciled before the owner can finally close out the project -- a portion of the retainage is set aside for this purpose. These payroll records are subject to audit and must

be maintained by both the contractor and the institution for at least three years.

Government agencies do not normally inspect the project while it is under construction, however, inspections can be requested by the owner at any time. In the case of a H.U.D. Direct loan, an inspection for Substantial Completion Status (80-85%) must be made before the sale of the bonds can be executed. All government agencies require a final inspection.

When the construction phase is nearly completed, the architect must completely inspect the project and prepare a "punch list" of items to be corrected or completed. This list is then forwarded to the contractor for execution. This "punch list" may be subject to negotiation between the owner and contractor with the architect acting as mediator. The contractor may contest some of the items appearing on the "punch list" claiming the conditions were out of his control or a particular problem was the result of a design flaw. Be prepared for some serious negotiations. Your bargaining power is the retainage money you hold pending the completion of the project. This money represents a substantial portion of the contractor's profit and he usually is willing to bargain. The institution should note, however, that all delays in the construction phase of the project cost the institution money. Most projects are built using interim or construction financing during the construction phase which is then converted to long-term financing at the completion of construction. The rates charged by

lenders for construction financing are usually substantially higher than the rates set for long-term financing. Delays are costly throughout the project as they increase the amount of time the institution must support the high interest rates charged for construction financing. However, delays near the end of the construction are proportionately more costly than delays at the beginning of the project. The reason for this higher cost is elementary -- the institution pays interest on only the money it has borrowed. Delays occurring near the beginning of the project force extra interest payments on a smaller principle than delays that occur when almost a f the money has been drawn down from the construction account. Because of this increasing cost factor, information that is needed for decisions that must be made during the construction phase must be quickly and accurately forwarded to the institution by the contractor and especially the architect. Similarly, decisions must be made by the institution in an equally efficient manner.

Close-out procedures vary from Federal agency to Federal agency, however, the essential elements remain. The institution must show the agency it has built what it said it was going to build, that it has properly maintained the required records and that the funds were used in a manner consistent with the Federal regulations. There will probably be some negotiations between you and the government at this point to reconcile the differences between the total project costs and

the eligible project costs, but remember the government is there to help you.

Upon formal acceptance of the building and assumption of long-term financing, you have completed your building. Now all that remains to be done is the scheduling of occupancy, the actual moving in process, and assumption of routine educational management headaches.

RESOURCES

Among the literally thousands of books, articles, manuals and fugitive papers available in the subject areas related to capital planning and construction, the following documents and agencies will be of particular usefulness:

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7. This chapter is substantially based upon material provided by Boston architect A. Anthony Tappe', of Huygens and Tappe', Inc., and from materials included in A Statement of Professional Services published by the American Institute of Architects.

8. This chapter is partially based upon material provided by Robert Judd, Department of Operations Research, University of Toledo, Ohio, and from Creative Approaches to Facilities Development, published by the Facilities Engineering and Construction Agency of D.H.E.W., 1971.

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